Stanford University Libraries
3 6105 001 170 245

BRANNER
GEOLOGICAL LIBRARY

STANFORD UNIVERSITY
LIBRARIES

Index of Geophysical Abstracts 140-143 1950

Index to Geophysical Abstracts 140-143
1950

GEOLOGICAL SURVEY BULLETIN 976

Abstracts of world literature
contained in periodicals,
books, and patents

DEPARTMENT OF THE INTERIOR
March 3, 1849

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1952

UNITED STATES DEPARTMENT OF THE INTERIOR

Oscar L. Chapman, *Secretary*

GEOLOGICAL SURVEY

W. E. Wrather, *Director*

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C. - Price 20 cents (paper cover)

INDEX TO GEOPHYSICAL ABSTRACTS 140–143, 1950

AUTHOR INDEX

A

No. Abst.

Abelès, Florin, The propagation of sinusoidal electromagnetic waves in stratified media 143 12461
Agamennone, Giovanni, Depth of focus derived from the angle of emergence of seismic waves 140 11717
—— Data on seismic events during 1947 obtained by the Central Office of Meteorology and Geophysics 141 11956
—— The earthquake of May 4, 1934 in the foothills of the Alpi Carniche 141 11957
Agarwala, K. S., Studies in seismology in the India Meteorological Department 143 12371
Ageno, Mario, Chiozzotto, Mario, and Querzoli, Ruggero, A new technique in the design of the scintillation counters 141 11970
Agnich, F. J., Geophysical exploration for limestone reefs 140 11829
Agocs, W. B., Computation charts for linear increase of velocity with depth 141 12037
Ahrens, Louis, Measuring geologic time by the strontium method 140 11759
Akademii͡a Nauk SSSR Vestnik, The new magnetic observatory 140 11694
Akimoto, Syun'iti. *See* under Nagata, Takeshi.
Aler, Bo, The efficiency of a scintillation counter for gamma rays 143 12415
Alfvén, Hannes, Discussion of the origin of the terrestrial and solar magnetic fields 142 12153
—— On the origin of the terrestrial and solar general magnetic field 143 12355
Aliverti, Giuseppina, Methods of radioactivity measurement in geophysical prospecting 140 11841
Aliverti, Giuseppina, and Solaini, Luigi, The velocity of propagation of seismic waves over short distances 142 12182
Alldredge, L. R., and Dichtel, W. J., Interpretation of Bikini magnetic data 140 11812
Alldredge, L. R. *See* Rumbaugh, L. H.
Allen, J. S. *See* Rossi, B. B.
Allsop, G., and Guénault, E. M., Exploders for simultaneous firing of shots 143 12479
Almeida Rolff, P. A. M. de, Radioactive minerals, notes on prospecting for them 141 12063
Altenburg, K., Dispersion of the longitudinal seismic waves 141 11945
Al'thausen, O. N., On certain regularities in production of thermo-remanent magnetism in magnetites 141 11937
Anderson, H. H., A hazard in oil exploration 141 12020
Anderson, H. L., and Koontz, P. G., Radiation counter, U. S. patent 140 11885
Andrée, H., A new diagram for computation of the permeability of reservoir rocks from laboratory measurements 142 12287
Andrée, Karl, Some geologic consequences of the formation of the earth by a cold process 143 12434
Ant͡syferov, M. S., The secondary resonances of a seismograph with spring suspension 142 12175
Archie, G. E., Introduction to petrophysics of reservoir rocks 141 11991
Arnett, R. A. *See* Heroy, W. R.
Arps, J. J., Apparatus for logging wells, U. S. patent 143 12498
Aslakson, C. I., Velocity of electromagnetic waves 140 11858
Ayres, W. A., Radio object position indicator using colors for distance indication, U. S. patent 141 12119

B

Baars, B., Tidal variations of the force of gravity 141 11909
Bachinskii, N. M., Antiseismic measures in the monumental architecture of Central Asia 140 11743
Bailey, F. G., Worldwide exploration progress 140 11783
Baker, J. S. *See* under Stick, J. C., Jr.
Baker, W. R. *See* under Kennedy, J. W.
Ballarin, S., Magnetic isoanomalies caused by a homogeneous parallelepiped uniformly magnetized in the geomagnetic field 141 12011
Balsley, J. R., James, H. L., and Wier, K. L., Aeromagnetic survey of parts of Baraga, Iron, and Houghton Counties, Mich., with preliminary geologic interpretation 140 11813

	No.	Abst.
Barbosa Braga, E., Subsurface exploration by geophysical methods	140	11802
Bardeen, Thomas, Crystal shake table for geophone studies	142	12291
Barnes, George W., Jr., Time interval recorder, U. S. Patent	142	12324
Bartels, Julius, Remarks on Dr. Howe's paper	142	12158
—— Scientific findings from the geophysical observations of the Helgoland explosion	142	12184
Bateman, J. D., Prospecting with the Geiger counter	142	12279
Bates, Charles. *See* Glenn, A. H.		
Bath, Markus, Travel time of the principal earthquake waves for Uppsala	140	11718
—— Some long period variations of microseismic activity	140	11737
Beamer, W. H. *See* Dodson R. W.		
Beck, A. F., Western Canadian plains—A new challenge to geophysics	141	11999
Beer, Michael, Measurements of gravity in the Canadian Arctic and Greenland	143	12349
Belluigi, Arnoldo, Inductive coupling of a homogeneous ground with a vertical coil	140	11831
—— The electromagnetic field due to induced currents in a conductive slab of finite dimensions	143	12462
—— "Bicaram"—A new electromagnetic apparatus	143	12463
—— Some theoretical considerations on electromagnetic measurements in mining galleries	143	12464
Bemrose, John, Heggblom, J. C., Holt, T. C., Richards, T. C., and Watson, R. J., Bahamas airborne magnetometer survey	141	12013
Bender, W. W., Jr., Bergen, W. B., and Purdy, W. G., Apparatus for calibrating vibration equipment, U. S. patent	141	12114
Benfield, A. E., The temperature in an accreting earth	14	11767
—— The earth's magnetism	142	12149
—— Heat flow below the oceans	143	12424
Benioff, Hugo, Seismic evidence for the fault origin of oceanic deeps	140	11735
Benson, A. C. *See* under Runcorn, S. K.		
Bergen, W. B. *See* under Bender, W. W.		
Bernard, Pierre, Microseismic recording at Nantes	143	12407
Bernholtz, Ben. *See* under Gilchrist, Lachlan.		
Berson, I. S., Indicator curves of the average seismic velocities in stratified media	140	11821
—— Interpretation of travel time curves of Mintrop's waves for a refracting boundary of arbitrary shape	142	12260
Bethune, P. de., The interior of the earth	142	12234
Biedendieck, C. H., An electrical drill-hole pressure meter	143	12474
Birch, Francis, Flow of heat in the Front Range, Colo	142	12217
Blaha, Friedrich, A method of making visible the spatial pattern of magnetic forces	143	12357
Blair, John Morris, and Hush, James M., Coincidence proportional counter, U. S. patent	140	11886
Blankenship, E. B. *See* under Hughes, D. S.		
Blau, Marietta, and Pregel, Boris, Alpha ray source and method of producing same, U. S. patent	141	12093
Boaga, Giovanni, Average errors in determinations of the deviation of the vertical	142	12128
Bödvarsson, Gunnar, On mountain making and basalt	142	12146
Bogdanov, A. A., Gurevich, B. L., and Shereshevskaı͡a, S. I͡A., Gravity anomalies and their relation to the principal tectonic elements in the western regions of the Ukrainian S. S. R.	143	12351
Bollo, Robert and Goguel, Jean, Gravity measurements in Brittany	142	12147
Bollo, Robert, and Gougenheim, André, On the periodic variation of gravity	142	12141
Bonchkovskii, V. F., Soviet science on the structure of the earth	143	12438
Bossolasco, Mario, Magnetic susceptibility of some minerals of the magnetite group	140	11701
Bourret, Weston, Aeromagnetic survey of the Allard Lake district, Quebec	140	11814
Bowen, W. A., Jr. *See* under Maple, E.		
Bowen, W. A., Jr. *See* under Singer, S. F.		
Branham, C. A., A brief commentary on magnetic surveying in the Appalachian area	141	12010
Brannock, W. W. *See* White, D. E.		
Brasil Conselho nacional de petroleo, Report for the year 1948	143	12441
Brekhovskikh, L. M., Reflection of plane waves from stratified media	142	12167
—— Reflection and refraction of spherical waves	142	12168
Breyer, Friedrich, The salt dome of Etzel	142	12240
Brimble, N. B., Side wall sample taker, U. S. patent	140	11902
Brockman, F. G., Apparatus for measuring radiant energy, U. S. patent	142	12303
Broding, R. A., Electrical-logging system, U. S. patent	143	12507
Broding, R. A. *See* under Stripling, A. A.		
Broggi, J. A., A course of lectures on seismology	143	12372
Brooks, J. A., Jr. *See* under Slotnick, M. M.		
Brown, F. W. *See* Gibson, F. C.		
Brown, Hart, A precision detail gravity survey, Jameson area, Coke County, Tex	140	11804

No. Abst.
Browne, B. C., Geophysical surveys and their utilization ... 140 11784
Browne, B. C., and Cooper, R. I. B., The British submarine gravity surveys of 1938 and 1946 ... 141 11927
Brownell, G. M., Radiation surveys with a scintillation counter ... 141 12067
Bruckshaw, J. M., Recent advances in geophysical prospecting ... 140 11785
Bruet, E., La Soufrière of Guadeloupe. Contribution to the study of pelean volcanic structures ... 142 12220
Bucher, W. H., The crust of the earth ... 142 12221
—— Megatectonics and geophysics ... 142 12222
Buchheim, Wilhelm, The problem of electrical transmission of seismic impulses over great distances by cable ... 142 12259
—— A new principle of electrical deep sounding ... 142 12272
Buell, M. W., Jr. *See* Hess, H. H.
Bukhnikashvili, A. V. *See* Kebuladze, V. V.
Bullard, E. C., The magnetic field within the earth ... 141 11935
—— The transfer of heat from the core of the earth ... 141 11986
—— Terrestrial magnetism ... 142 12150
—— Electromagnetic induction in a rotating sphere ... 142 12151
Bullen, K. E., Compressibility-pressure hypothesis and the earth's interior ... 141 11981
—— An earth model based on a compressibility-pressure hypothesis ... 141 11982
—— On the constitution of Mars ... 141 11983
Bureau des Recherches géologiques et géophysiques, Electrotelluric prospecting of Bresse and Bas-Dauphiné ... 142 12276
Bush, R. E., Radioactivity well log interpretation in the East Texas Field ... 140 11850
—— Porosities can be obtained from radioactivity logs in West Texas. Examples of quantitative technique shown for Scurry County ... 142 12286
Bush, R. E., and Campbell, J. L. P., Limestone completions through radioactivity logs ... 140 11851
Byerly, Perry, Mei, A. I., and Romney, Carl, Dependence on azimuth of the amplitudes of *P* and *PP* ... 140 11716

C

Caan, A. J. Z., Optical recording apparatus for seismic waves, U. S. patent ... 143 12488
Cagniard, Louis, On the phenomena of electromagnetic induction in a conductive sphere. Geophysical applications ... 142 12152
Cagniard, Louis, and Goudey, Raoul, On an indirect comparison of the reference values adopted for the intensity of gravity at Paris and Potsdam ... 140 11690
Calhoun, J. C., Jr., Correlation of formation-resistivity factor with porosity ... 140 11835
Callahan, J. T. and Lahmeyer, J. D., Method of geophysical prospecting, U. S. patent ... 143 12492
Caloi, Pietro, Two characteristic types of microseismic disturbances ... 143 12408
Caloi, Pietro, Marcelli, L., and Pannocchia, G., Velocity of the propagation of surface waves under the Atlantic Ocean ... 141 11954
—— Further note on the velocity of surface waves through sub-Atlantic paths. An attempted exploration of Atlantic basin deeps using the dispersion curve of L_Q waves ... 143 12384
Calver, C. M. G., Vibrating table, U. S. patent ... 141 12125
Campbell, F. F., The Fort Cobb anticline ... 143 12455
Campbell, J. L. P., and Winter, A. B., Dry gas sand location by neutron logs ... 140 11852
Campbell, J. L. P. *See* Bush, R. E.
Campbell, O. E., A method of prospecting for Kansas "shoestrings" ... 141 12074
Cannon, G. E. *See* Huber, T. A.
Cantos Figuerola, José, Hydrological investigation around Ciudad Real ... 141 12008
—— Confirmation by exploratory drilling of seismic prospecting results in Miajadas ... 142 12264
Carlin, J. R. and Clarke, E. T., Measurement of the intensity of penetrative radiations, U. S. patent ... 143 12494
Carlson, R. F., Portable mud-logging equipment in Elk City field ... 140 11856
Carome, E. F., An electronic vibration meter ... 142 12258
Carr, D. R. *See* Kulp, J. L.
Carreño, Alfonso de la O., Present state of gravimetric exploration in Mexico ... 140 11803
—— Maps of gravity anomalies in Mexico ... 142 12145
Casertano, Lorenzo, The contribution of heat derived from disintegration of radioactive substances in the earth ... 141 11972
Cassinis, R., Induction magnetometers ... 141 12012
Castet, J., Electromagnetic variometer of the A-type ... 142 12161
Castro, Honorato de, Variations of gravity ... 142 12142
Ceng, Youngtsen. *See* under Ku, K. G.
Cervera del Castillo, E., Radioactive logging in northeastern Mexico ... 143 12472
Chamberlain, Owen. *See* Segre, Emilio G.

No. Abst.
Chaney, P. E., Method for logging wells, U. S. patent 143 12502
Chang, C. Y. *See* under Ku, K. G.
Chang, T. H., Application of Wenner's method 141 12057
Chao, J. S., and Tsung, F. T., The gravity measurement in Shanghai City 141 11934
Chen, P. C., A detailed geomagnetic survey of Pehpei district, Szechwan, China 141 11941
Cherry, L. B. *See* Harrison, T. R.
Chiozzotto, Mario. *See* Ageno, Mario.
Claassen, H. H., Transducer for ultrasonic waves, U. S. patent 141 12117
Clark, A. R. *See under* Gilchrist, Lachlan.
Clarke, E. T. *See* Carlin, J. R.
Cleaver, L. T. *See* Daum, C. R.
Clewell, D. H., and Simon, R. F., Seismic wave propagation 141 12025
Closs, Hans, On the gravity pattern over the salt domes of northwestern Germany 142 12245
Coates, J. *See* Evans, P.
Coats, R. R., Volcanic activity in the Aleutian arc 143 12428
Cockerell, R. L. R., Pendulum inclinometer, U. S. patent 141 12115
Cole, J. H., Geodesy in Egypt 141 11908
Cook, A. H., Values of gravity at stations in southern Britain 141 11926
—— Measurements of gravity in Ireland 143 12352
Cook, A. H. *See also* Thirlaway, H. I. S.
Cook, K. L., Magnetic surveys in the Iron Springs district, Iron County, Utah 141 12015
—— Quantitative interpretation of vertical magnetic anomalies over veins 143 12449
Cooper, R. I. B., Recent advances in the technique of submarine gravity surveying 141 11912
Cooper, R. I. B. *See* Browne, B. C.
Cooper, W. G. G., Electrical aids in water finding 143 12468
Coppens, René, Study of radioactivity of certain rocks by photographic method 143 12421
Coron, Suzanne, Value of gravity at Paris in the Potsdam system 141 11928
Coulomb, Jean, Microseisms 142 12200
Coulomb, Jean, and Molard, Pierre, Seismic waves over the bottom of the Caribbean Sea 142 12178
Cox, Harris, Geophysical exploration in the Paraguayan Chaco 140 11791
Crumrine, K. C., Neutron detection, U. S. patent 141 12096
—— Radiological well logging, U. S. patent 141 12106
—— A method of electrical profiling 142 12273
Crumrine, K. C. *See* under Herzog, Gerhard.
Csongor, Eve. *See* Szalay, A.
Cumming, J. L., Petroleum, its origin, geology, and methods of exploration 140 11792
Cummings, J. B., and Romslo, T. M., Investigation of Twin Buttes copper mines, Pima County, Ariz 143 12470
Cunietti, Mariano, Fifty-one relative determinations of gravity in northern Italy in 1949 141 11931
—— The gravimetric tying of the stations Padova, Bologna, and Milan using the Western G-4A gravimeter 142 12131
Curtiss, L. F., Measurements of radioactivity 140 11747
—— The Geiger-Müller counter 140 11749
Curtiss, L. F., Evans, R. D., Johnson, Warren, and Seaborg, G. T., Units of radioactivity 140 11748
Curtiss, L. F. *See* Krasnow, Shelly.

D

Dahlberg, R. S., Jr., Seismic wave transmitter, U. S. patent 142 12297
Dahm, C. G., Seismic prospecting method, U. S. patent 141 12080
Damon, P. E., Radioactivity and mineralization in rhyolite porphyry 141 11971
Darling, F. W., Fundamental tables for the deflection of the vertical 140 11680
da Silva Gamerio, José. *See under* de Andrade, Adalberto.
Daum, C. R., and Cleaver, L. T., Electronic detector, U. S. patent 141 12084
Davis, G. L., and Hess, H. H., Radium content of ultramafic igneous rocks II. Geological and chemical implications 140 11764
de Andrade, Adalberto, Short notes on the use of the magnetic method in prospecting for magnetite ores in Alentejo 142 12249
de Andrade, Adalberto, Martins da Silva, João, Dos Reis Arrude, Carlos, and da Silva Gamerio, José, Iron mines of Montemór-o-Novo 142 12248
de Boisblanc, D. R., Detonation voltage measuring means, U. S. patent 143 12510
—— Detonation meter, U. S. patent 143 12511
Deegan, C. J., Helicopters now routine in oil exploration 140 11866
Delaney, C. F.G. *See* Poole, J. H. J.
Denning, C. O., and Yancey, J. R., Side wall coring tool, U. S. patent 141 12108
Deputy, L. F. *See* Deputy, L. R.

	No.	Abst.
Deputy, L. R. and Deputy, L. F., Geophysical safety catch, U. S. patent	143	12509
de Sitter, L. U., Geophysical survey of the southeast Netherlands	142	12245
Dessau, G., The Geophysical Section of the Geological Survey of India	140	11798
—— Some results of geophysical prospecting conducted for the Geological Survey of India from 1945–1948	143	12442
DeVilliers, John. *See* under Nel, L.T.		
d'Henry, G., The physical nature of microseisms	143	12409
See also under Morelli, Carlo.		
Dichtel, W. J. *See* Alldredge, L. R.		
Dietert, H. W., Steinmueller, R. E., and King, C. M., Permeability meter, U. S. patent	142	12329
Di Filippo, Domenico, The Azores earthquake of Nov. 25, 1941	140	11719
Gutenberg's *G*-wave in the Azores earthquake of Nov. 25, 1941	141	11955
Di Filippo, Domenico, and Marcelli, L., The magnitude of earthquakes and its determination at the Rome seismological station	142	12189
Dix, C. H., Pulse propagation in two spatial dimensions	142	12169
Dixey, F., Modern methods of mineral exploration	140	11794
Dobrin, M. B., Submarine geology of Bikini Lagoon as indicated by dispersion of water-borne explosion waves	143	12388
Dodson, R. W., and Beamer, W. H., Method and apparatus for measuring alpha-particle radiation, U. S. patent	142	12305
Doll, H. G., The S. P. log	142	12284
Vibration insensitive galvanometer, U. S. patent	142	12323
Doll, H. G., Legrand, J. C., and Stratton, E. F., Electric logging systems	140	11843
Dos Reis Arrude, Carlos. *See* under de Andrade, Adalberto.		
Dudley, F. E., Radiation counter tube, U. S. patent	140	11882
Due Rojo, Antonio, The new seismograph of the Cartuja seismological station	141	11947
Dupouy, G., Disturbances of the geomagnetic field and of telluric currents by electric railways	142	12162
E		
Eblé, Louis, On the variations of the vertical	142	12143
Eby, J. B., The progress of science in petroleum exploration	140	11786
Eckhardt, E. A., Geophysical activity in 1948	140	11787
—— Geophysical activity in 1949	142	12236
Egyed, László, The elevation correction of anomalies	140	11684
Eisler, J. D. *See* under Silverman, Daniel.		
Elsasser, W. M., Causes of motions in the earth's core	140	11987
—— The earth's interior and geomagnetism	141	11988
Emery, K. O., A suggested origin of continental slopes and of submarine canyons	142	12229
Enenstein, B. S., Electromagnetic processes in circuits employed in prospecting by electrical methods	141	12044
—— Results of field experiments on the building up of the electrical field in the ground	142	12270
English, J. F., Jr. *See* Rutherford, V. S.		
Epinat'eva, A. M., On certain types of diffracted waves recorded on seismograms	141	12030
Ermert, E. A., Magnetic exploration of a syenite reef at western Witwatersrand	141	12017
Escher, B. G., Origin of the asymmetrical shape of the earth's surface and its consequences upon volcanism on earth and moon	140	11770
Evans, J. F. *See* under Silverman, Daniel.		
Evans, P., and Coates, J., Geophysical prospecting for oil in India	141	12000
Evans, R. D. *See* under Curtiss, L. F.		
Evseev, S. V., Reduction of gravity force in mountainous regions	143	12345
Ewing, Maurice, Seismic studies in ocean basins	140	11729
Ewing, Maurice, Tolstoy, Ivan, and Press, Frank, Proposed use of the *T* phase in tsunami warning systems	141	11952
Ewing, Maurice, Worzel, J. L., Hersey, J. B., Press, Frank, and Hamilton, G. R., Seismic refraction measurements in the Atlantic Ocean basin	140	11730
—— Seismic refraction measurements in the North Atlantic Ocean basin	142	12187
Ewing, Maurice, Worzel, J. L., Steenland, N. C., and Press, Frank, Geophysical investigations in the emerged and submerged Atlantic Coastal Plain	142	12188
See also under Press, Frank, and Tolstoy, Ivan.		
F		
Fabiani, Ramiro, Problems and methods of petroleum exploration	143	12439
Fahrner, Ted, Wide range radiation intensity meter, U. S. patent	143	12491
Faul, Henry, Tittle, C. W., and Goodman, Clark, Neutron logging of drill holes	140	11848
See also under Tittle, C. W.		

No. Abst.

Fearon, R. E., Alternating current ionization chamber, U. S. patent 141 12085
—— Well survey method and apparatus, U. S. patent 141 12111
—— Magnetic gradient measurement, U. S. patent 142 12295
Fearon, R. E., Thayer, J. M., and Swift, Gilbert, Method and apparatus for producing neutron logs of drill holes, U. S. patent 142 12311
—— Neutron well logging, U. S. patent 142 12312
—— Neutron well logging, U. S. patent 142 12313
See also under Swift, Gilbert, and Thayer, Jean M.
Ferraz de Carvalho, Anselmo, Studies in geology and geophysics 143 12368
Festa, C., and Santangelo, M., Radioactivity of the earth 141 11966
—— On the disintegration of K^{40} 143 12418
Fiano, R. G., Special cases of the indicatrix curve in electromagnetic prospecting methods 140 11830
Finley, J. C., *See* under McGee, D. A.
Finn, R. S. *See* under Hawkins, James E.
Fontseré, Eduardo, Earthquakes in Catalonia during 1945 142 12194
—— Earthquakes in Catalonia during 1946 and 1947 142 12195
Förtsch, Otto. *See* Schulze, G. A.
Frank, Marco, New method of reproduction 140 11867
Franzén-Lutz, Britta, and Lutz, J. P., Apparatus for determination of moisture content, U. S. patent 142 12330
Friedman, Herbert, Geiger-Mueller counter structure, U. S. patent 140 11893
Fries, Carl, Jr., and Gutiérrez, Celedonio, Activity of Parícutin volcano from August 1, 1948 to June 30, 1949 141 11975
—— Activity of Parícutin volcano from July 1 to December 31, 1949 143 12431
Fritsch, Volker, Note on some recent investigations by the radio wave method 140 11839
—— Principles of the electrical methods in applied geophysics 142 12267
Frolov, A. I., The effect of the vertical temperature gradient on the determination of gravity by pendulum measurements 142 12137
—— The dynamic temperature coefficient of pendulums 142 12138

G

Galanopulos, A. G., The seismicity of Messenia 143 12393
Garcia Rojas, Antonio, Gravitational methods used in industrial exploration 140 11800
—— Gravimetric exploration 141 12006
Garcia Siñeriz, José, Geophysical exploration in Larache 140 11805
Garrison, A. D. *See* under Herzog, Gerhard.
Gassmann, Fritz, and Weber, Max, The crystal accelerometer of the Institute for Geophysics of the Federal Technical High School 143 12375
Gassmann, Fritz. *See* under Weber, E. K.
Geoffroy, P. R., and Koulomzine, T., Need for new policies and new tools in mining geophysics 141 11994
Geologisches Landesamt, Geotectonic map of northwestern Germany 140 11779
Geophysical Directory, The, 5th ed 142 12237
Ghiorso, Albert, and Gordon, C. M., Radiation detecting apparatus, U. S. patent 140 11883
Gibson, F. C., and Brown, F. W., Vibrator type multiple-shot blasting unit, U. S. patent 141 12082
Gilbert, R. L. G., A dynamic gravimeter of novel design 140 11681
Gilchrist, Lachlan, Clark, A. R., and Bernholtz, Ben, Methods of determination of the average resistivity of a two-layered medium 142 12269
Gilchrist, Lachlan, Rostoker, Normon, and Bernholtz, Ben, Distribution of potential in a two-layered medium due to an internal source and sink and the determination of the approximate average resistivity of the medium 140 11832
Gilmour, Andrew, The state of seismic prospecting 142 12255
Gimeno Riutort, Antonio, Seismic events in Spain during 1947 142 12196
Giorgi, Maurizio, Periods of the maximum phase in distant earthquakes 142 12180
Giorgi, Maurizio, Medi, Enrico, and Morelli, Carlo, Regional magnetic survey of the Marche region for the establishment of an [Italian] Central Magnetic Observatory 143 12366
Giorgi, Maurizio, and Rosini, E., The nature of the causes that generate microseisms 143 12410
Glaessner, M. F., Geotectonic position of New Guinea 141 11979
Glenn, A. H., and Bates, Charles, The meteorological and oceanographic aspects of geophysical prospecting 141 12077
Gloden, Albert, Theoretical comparison of two neighboring gravimetric stations 142 12132
Goble, R. W., and Jackson, Gordon, Methods of and apparatus for transmitting intelligence to the surface from well bores, U. S. patent 140 11896
Goetsch, A. H., Underwater meter-leveling device, U. S. patent 141 12118

No. Abst.

Goguel, Jean, Introduction to the study of mechanics of the deformations of the crust of the earth. 141 11978
——— A tentative interpretation of the geophysical survey of Bresse and Bas-Dauphiné 141 12059
——— Attempt at the interpretation of geophysical prospecting of Bresse and of Bas-Dauphiné 142 12277
——— The secular displacements of the pole 143 12435
Goguel, Jean. *See* Bollo, Robert.
Golay, M. J. E., Method and apparatus for measuring radiation, U. S. patent 140 11894
Goldin, A. S., Rohrer, E. R., and Maclen, R. L., Scintillation type alpha-particle detector, U. S. patent 142 12280
Goldstein, Ladislas, and Pregel, Boris, Exploring for radioactive bodies, U. S. patent 140 11891
Good, S. E., and Pettijohn, F. J., Magnetic survey and geology of the Stager area, Iron County, Mich 140 11820
Goodman, Clark. *See* under Faul, Henry, and Tittle, C. W.
Goranson, R. W. *See* under Tuve, M. A.
Gordon, C. M. *See* Ghiorso, Albert.
Gorshkov, G. P., Earthquakes in the territory of the Soviet Union 143 12394
Goudey, Raoul. *See* under Cagniard, Louis.
Gougenheim, André. *See* Bollo, Robert.
Gough, D. I. *See* under Hales, A. L.
Graf, T., Construction of a multiple gamma counter of high efficiency and short resolving time 143 12416
Graham, J. W. *See* under Torreson, O. W.
Graves, E. R., Method and apparatus for detecting ionizing particles, U. S. patent 141 12088
Green, A. E., and Zerna, W., Theory of elasticity in general coordinates 142 12166
Green, C. H., The relationship of research and field operations in seismic explorations 141 12019
Greenman, W. G., Petroleum exploration in Arctic Alaska 140 11793
Greig, J. W. *See* under Tuve, M. A.
Grenet, Gaston, Electromagnetic variometer for recording rapid variations of the geomagnetic field 142 12160
Gross, M. H., Method and means for automatic tracking and/or ranging, U. S. patent 141 12120
Grushinskiĭ, N. P., The use of gravimeters for the measurements at stations of the first and second order 142 12136
——— The dynamic temperature effect of a gravimeter 142 12139
Guénault, E. M. *See* Allsop, G.
Guerra Peña, Felipe, Introduction to photogeology 141 12076
Guimarães, Djalma, Geologic chronology based on the atomic disintegration of radioactive minerals 142 12210
Gurevich, B. L. *See* under Bogdanov, A. A.
Guseman, L. F., Geophysics accepts a challenge 140 11827
Gustafsson, G. V. A. *See* under Lindblad, A. R.
Gutenberg, Beno, Structure of the earth's crust in the continents 140 11727
——— Properties of the earth's crust beneath the oceans 140 11728
——— Earthquakes in North America 142 12190
Gutíerrez, Celedonio. *See* under Fries, Carl, Jr.

H

Haarstick, Fritz, The path-time curve in the seismic reflection 143 12452
Hales, A. L., Wijk, A. M. van, and Gough, D. I., The magnetic field of the earth 140 11697
Hallenbach, Franz, The Schweydar method of computing the topographic reduction to the gravity gradient 141 11921
——— Physical properties of rocks, their determination and use 143 12444
Halliday, D. J., Geodetic measurements by radar 140 11859
Hamilton, G. R. *See* under Ewing, Maurice.
Hammer, Sigmund, Density determinations by underground gravity measurements 143 12447
Handley, A. J., Geophysical reflections 140 11823
Hardtwig, Erwin, Ground unrest or microseisms 142 12201
——— Hypotheses on the internal constitution of the earth 142 12235
Hare, D. G. C., Amplifying and quenching circuits for radiation detectors, U. S. patent 141 12089
Harrison, T. R. and Cherry, L. B., Measuring and control method and apparatus, U. S. patent 143 12482
Hasbrook, A. F., Apparatus for recording time intervals, U. S. patent 140 11876
Haskell, N. A., A substitution method for the absolute calibration of vibration pick-ups 140 11862
Hatsuda, Zin'ichiro, On the radioactive exploration 141 12060
Hattori, Yasumasa, On the transmission of the shot-instant in seismic refraction method 141 12024
Hawkins, J. E., Testing device for seismic signal apparatus, U. S. patent 140 11874
——— Geophysical prospecting system, U. S. patent 142 12331
——— Radio position determining system, U. S. patent 142 12332

	No.	Abst.
Hawkins, J. E., Radio survey system, U. S. patent	142	12333
—— Geophysical prospecting system, U. S. patent	142	12336
—— Radio position determining system, U. S. patent	142	12337
—— Radio location system, U. S. patent	142	12338
—— Radio-location system, U. S. patent	142	12339
Hawkins, J. E., and Finn, R. S., Radio position determining system, U. S. patent	142	12334
Hawkins, J. E., and Koeppel, B. W., Radio position finding system, U. S. patent	142	12335
Hayes, R. C., Earthquakes in New Zealand during the year 1947	140	11721
Hayward, J. T., Apparatus for logging wells in terms of drilling rates, U. S. patent	140	11899
—— Method of logging wells, U. S. patent	143	12503
—— Radio-activity logging of wells, U. S. patent	143	12504
Hazebrook, P., Note on the analysis of oblique reflection data	141	12039
Hée, Arlette, Investigation of the radioactivity of a granite from the Vosges by the photographic method	143	12422
Hée, Arlette, Jarovoy, Michel, and Kleiber, Joseph, Study by the photographic method of active deposits of various radioactive substances	142	12216
—— Study of radioactive deposits present in rocks	143	12423
Heggblom, J. C. *See* under Bemrose, John.		
Heiland, C. A., Galvanometer, U. S. patent	143	12512
Heinrich, R. R., The Mississippi Valley earthquake of June 30, 1947	141	11961
Heiskanen, W., and Sala, I., The topographic-isostatic reduction of gravity anomalies by the aid of small scale maps	141	11922
Henderson, R. G., and Zietz, Isidore, The computation of second vertical derivatives of geomagnetic fields	140	11806
—— The upward continuation of anomalies in total magnetic intensity fields	140	11807
Henson, R. L., Jr., Seismic detector, U. S. patent	143	12486
Henson, R. L., Jr., and Millington, J. W., Drive for seismographic record strips, U. S. patent	143	12485
Heroy, W. R., and Arnett, R. A., Seismic surveying	141	12018
Herrick, H. N., and Schaufelberger, W. M., Method and apparatus for determining magnetic properties of well cores, U. S. patent	140	11870
Hersey, J. B. *See* under Ewing, Maurice.		
Hertwig, August, The place of technical experiments in soil mechanics	143	12458
Herzog, Gerhard, Voltage control and stabilizing circuits, U. S. patent	140	11884
—— Linear integration meter, U. S. patent	140	11892
—— Well logging detector calibration, U. S. patent	140	11897
—— Voltage control and stabilizing circuits, U. S. patent	140	11898
—— Well logging, U. S. patent	141	12101
—— Radiological well logging, U. S. patent	141	12110
—— Prospecting, U. S. patent	143	12496
Herzog, Gerhard, and Crumrine, K. C., Neutron detection, U. S. patent	140	11890
Herzog, Gerhard, and Garrison, A. D., Radioactive measuring, U. S. patent	141	12097
Hess, H. H., and Buell, M. W., Jr., The greatest depth in the oceans	141	11980
See also under Davis, G. L.		
Hill, M. N., and Swallow, J. C., Seismic experiments in the Atlantic	140	11731
Hinch, W. W. *See* Molloy, E. W.		
Hine, G. J., Sensitivity of gamma-ray counters	140	11750
Hirano, Kintaro. *See* Takahashi, Ryutaro.		
Hirao, Kunio. *See* under Nagata, Takeshi.		
Hirvonen, R. A., On the establishment of the values of gravity for the national reference stations	141	11919
Hodge, M. W. *See* Wulf, O. R.		
Hofmann, Walter, A formula for computing the vertical gradient of gravity	140	11685
Holden, C. R., Electromechanical transducer, U. S. patent	140	11879
Holland, H. D., and Kulp, J. L., Alpha activity of rocks and sediments by scintillation counting	140	11755
Holmes, Arthur, Lead isotopes and the age of the earth	142	12212
Holt, T. C. *See* under Bemrose, John.		
Honnell, P. M., The application of feedback to an electromechanical transducer for seismograph testing	142	12289
—— The absolute calibration of a Brush accelerometer and its response to square waves of displacement and velocity	143	12478
Howe, H. H., The *u*-measure of magnetic activity	142	12157
—— An anomaly of the magnetic daily variation at Honolulu	143	12362
Howell, B. F., Jr., Ground vibrations near explosions	140	11822
Huber, A., The theory of the geoelectric-resistivity methods	143	12459

No. Abst.

Huber, T. A., and Cannon, G. E., Apparatus for logging boreholes, U. S. patent ... 140 11906

Hughes, D. S., Blankenship, E. B., and Mims, R. L., Variation of elastic moduli and wave velocity with pressure and temperature in plastics ... 142 12232

Hughes, D. S., and Jones, H. J., Variation of elastic moduli of igneous rocks with pressure and temperature ... 142 12231

Huntington, H. B. *See* Price, W. J.

Hurley, P. M., Radioactivity and time ... 140 11760

—— Progress report on age measurements ... 140 11763

—— Distribution of radioactivity in granites and possible relation to helium age measurements ... 140 11765

—— Airborne magnetic survey in Maine ... 140 11815

Hurley, P. M., and Thompson, J. B., Airborne magnetometer and geological reconnaissance survey in northwestern Maine ... 142 12252

Hush, J. M. *See* Blair, J. M.

Hvoroslev, M. J., Subsurface exploration and sampling of soils for civil engineering purposes ... 142 12239

Hysom, R. L., The search for oil ... 141 11993

I

Iida, Kumizi, Rate of changes in elastic wave velocity with pressure ... 141 12029

Ikegami, Ryohei, A nomogram for magnification of seismometer ... 143 12379

—— On the anomalous distribution of the maximum amplitude of earthquake motions ... 143 12403

Ikegami, Ryohei. *See* Kishinouye, Fuyuhiko.

Imamura, Akitsune, Land deformations associated with the recent Tōkaidō earthquake ... 141 11958

Inagaki, H. *See* under Kiyono, Takeshi.

Informaciones y Memorias de las Sociedad de Ingenieros del Peru, The geophysical observatory of Huancayo ... 141 12004

Ingham, F. T., Iron ... 143 12450

Inglada Ors, Vicente, A note on the depth of focus of the earthquake in the Tuscany-Romagna region of the Appennines, February 11, 1939 ... 140 11720

—— Results of recent seismological studies ... 141 11942

Ingram, R. E., Note on the magnification curve of a seismograph recording through a galvanometer ... 141 11948

Innes, M. J. S., An investigation of the applicability of gravimetric and magnetometric method of geophysical prospecting ... 141 12009

Ippolito, Felice, Recent data concerning the age of the earth ... 143 12420

Irons, H. R. *See* Schonstedt, E. O.

Ising, Gustaf, Attempts to replace the elastic comparison force in gravimeters by capillary and electrostatic forces ... 140 11682

Ito, Junji. *See* Kiyono, Takeshi.

Ives, R. L., Laboratory power supply for vibrator-type portable Geiger-counters ... 141 11969

J

Jackson, Gordon. *See* Goble, R. W.

Jaggar, T. A., Steam-blast volcanic eruptions ... 143 12426

James, H. L. *See* under Balsley, J. R.

Jardetzky, Wietcheslaw, On the rotation of the earth during its evolution ... 140 11768

Jaroszewicz-Halicka, Antonina, Organization of the Interdepartment Geophysical Institute of Warsaw ... 141 12005

Jarovoy, Michel. *See* under Hée, Arlette.

Jeffreys, Harold, On the absolute measurement of gravity ... 141 11918

—— Dynamic effects of a liquid core ... 141 11989

—— On the radioactivity of potassium ... 142 12209

Jelstrup, G., Description of the Nørgaard gravimeter ... 140 11683

Jemma, Raimundo, Geophysics applied to industry ... 141 12042

Johansson, S. A. E., Some applications of scintillation counters ... 143 12417

Johnson, E. A., Submarine-detecting device, U. S. patent ... 143 12481

Johnson, Warren. *See* under Curtiss, L. F.

Jones, H. J. *See* Hughes, D. S.

Jones, L., Gravimetric survey of Belgium 1947–1948 ... 140 11691

Jones, P. H. *See* Maher, J. C.

Jones, W. R., and Williams, David, Minerals and mineral deposits ... 142 12238

Joset, Alain. *See* Martin, Jean.

Joubin, F. R., Modern methods of mineral exploration in Canada ... 140 11795

	No.	Abst.
Júdice, António, The determination of normal gravity in geodesy	143	12341
——— The problem of the figure of the earth	143	12342
Jurney, E. T., and Maienschein, Fred, The gamma-ray counting efficiency for a lead-cathode G-M counter	140	11752

K

	No.	Abst.
Kaiser, H. F., Radiographic scanning unit, U. S. patent	141	12094
Kanai, Kiyoshi, On the existence of the M_2 waves in actual seismic disturbance	143	12383
Kanai, Kiyoshi. *See* Sezawa, Katsutada.		
Kanne, W. R., Detecting device, U. S. patent	142	12300
Kato, Motohiko, On the first and the second differential coefficients of potentials of the arbitrary distributed masses	141	12007
Kazanskiĭ, I. A., The present state and the prospects of gravimetric studies of the earth	142	12127
——— Considerations on the establishment of an adjusted value of absolute gravity to be used in the universal gravimetric survey	142	12129
Kean, C. H., Acoustic well-logging apparatus, U. S. patent	143	12505
Kebuladze, V. V., and Bukhnikashvili, A. V., Organization of the daily and short cycle variations of telluric currents at Dusheti	142	12203
Kehl, W. L. *See* under Muskat, Morris.		
Kellogg, E. W., Dynamic galvanometer, U. S. patent	141	12123
Kelly, S. F., Geophysical and geological approach to mining problems	141	11995
——— Geophysics in the exploration, exploitation, and conservation of water	141	11998
Kemp, C. E., Geiger counter reconnaissance in upper Michigan	141	12062
Kennedy, J. W., Baker, W. R., and Wiegand, C. E., Electronic counting circuits, U. S. patent	143	12495
Kiebert, M. V., Jr., Frequency-modulated direction- and range-finding apparatus, U. S. patent	141	12121
Kilchling, Karl, The Eötvös torsion balance	142	12133
——— New types of torsion balance for gravity measurements	142	12134
——— A torsion balance measuring U_{xxy} and U_{xxy}	142	12135
Kimura, Kiichi, Study on radioactivity of hokutolite in Taiwan by means of a counter with linear amplifier	140	11756
Kimura, Kiichi, and Uemura, Yoshiaki, A counting instrument with linear amplifier	140	11751
King, C. M. *See* under Dietert, H. W.		
King, P. B., Tectonic framework of southeastern United States	142	12226
Kirnos, D. P. *See* Savarenskiĭ, E. F.		
Kishinouye, Fuyuhiko, and Ikegami, Ryohei, A study of microseisms after A. W. Lee's method	141	11963
Kisslinger, Carl, Velocity of longitudinal waves in some Paleozoic formations in the vicinity of St. Louis, Mo	141	11949
Kiyono, Takeshi, Theoretical study on the ground resistivity method of electrical prospecting	141	12051
Kiyono, Takeshi, Inagaki, H., and Shibata, B., Resistivity curves for semi-circular disc	141	12053
Kiyono, Takeshi, and Ito, Junji, A contribution to the theory of electro magnetic prospecting	141	12043
Kleiber, Joseph. *See* under Hée, Arlette.		
Klompé, Th. H. F. and Petroeschevsky, W. A., Volcanological investigations in Indonesia	143	12432
Koeppel, B. W. *See* Hawkins, J. E.		
Kolmogorov, A. N., Determination of the coefficient of thermal diffusivity of the soil	141	12068
Konakhovich, I͡U. I͡A., Latyshev, G. D., and T͡Simbalin, V. V., The measurement of the magnetic field by the induction method	140	11695
Kondorskiĭ, E. I., The theory of magnetic properties of conglomerates and powdered substances	143	12358
Koontz, P. G. *See* Anderson, H. L.		
Korff, S. A., Counters	142	12206
——— Proportional counters	142	12207
Korn, H., and Martin, Hans, Earthquakes in South-West Africa	143	12396
Koshikawa, Yoshiaki, Magnetic survey in the area of topographical deformation of Volcano Usu	143	12367
Koulomzine, T. *See* Geoffroy, P. R.		
Krasnow, Shelly, Shielding method and apparatus for radioactive borehole logging, U. S. patent	142	12317
Krasnow, Shelly, and Curtiss, L. F., Radiant energy activation, U. S. patent	140	11903
Krey, Theodore, The recognition and evaluation of reflections	141	12031
——— Influence of refraction phenomena in seismic prospecting by the reflection method	142	12261
——— Examples of the results of seismic investigations by the reflection method in northwestern Germany	143	12457
Krinitzsky, E. L., Geological investigation of faulting in the lower Mississippi Valley	143	12390
Krouskij, L., Determination of the slope and true depth of layers from seismic reflection data	141	12032
Kruger, F. C., and Lacy, W. C., Geological explanation of geophysical anomalies near Cerro de Pasco, Peru	140	11836
Ku, K. G., Ceng, Youngtsen, and Chang, C. Y., Isostatic anomalies of 208 Chinese gravity stations	142	12148

No. Abst.

Kuhn, Werner, On the homogeneity of the earth's interior 140 11736
Kulp, J. L., and Carr, D. R., Surface area of deep sea sediments 140 11758
Kulp, J. L. *See* Holland, H. D.
Kunz, Bruno, The gradient in geophysics 141 11992
Kurata, Nobuo, Ochiai, Toshiro, and Murashita, Toshio, Electric resistivity curves as the index of geological conditions 141 12054

L

Lacy, W. C. *See* Kruger, F. C.
Lagerquist, P. A., Experimental investigations on gravimetry 141 11910
Lagrula, Jean, Recent determinations of gravity in Algeria, Morocco, and the Sahara 141 11932
Lahmeyer, J. D. *See* Callahan, J. T.
Langhammer, A., Comments on L. Krouskij's paper: The determination of the true inclination and depth of layers from seismic reflection data 143 12453
Lapwood, E. R., The disturbance due to a line source in a semi-infinite elastic medium 140 11709
Latyshev, G. D. *See* Konakhovich, I͡U. I͡A.
Lebourg, M. P., Side wall sample taker, U. S. patent 141 12109
Leet, L. D., Earth waves 140 11704
—— Discussion of tripartite microseismic measurements 140 11738
—— Microseisms 140 11739
Legrand, J. C. *See* Doll, H. G.
Lehmann, Inge, On two explosions in Danish waters in the autumn of 1946 142 12183
Leiviskä, Iivari, Breaks, earthquakes and processes of the glacial age in their influence on the structure of rocks 143 12436
Lejay, Pierre, Gravimetric survey of the Philippine Islands 143 12353
Lemcke, Kurt, On the tectonics of the seismic region of the Hohenzollernalb 140 11722
Lesage, M., Rogozinski, A., and Voisin, A., Construction of Geiger-Müller counters of all-metal type 141 12066
Lindblad, A. R., Malmqvist, J. D. and Gustafsson, G. V. A., Method of geophysical exploration, U. S. patent 143 12489
Lipskaia, N. V., The pattern of the electric field produced by a point source as observed on the earth's surface near a buried conductive sphere 140 11833
Liston, M. D., Radiation detecting apparatus, U. S. patent 140 11888
Loper, G. B., Gain control system for seismographs, U. S. patent 143 12483
Lorenz, Hans, The present status of the dynamic ground exploration 142 12257
—— The use of the seismic exploration method during dam construction 142 12263
Lozano Calvo, Luis, On the interpretation of isostatic anomalies 140 11679
—— Density and pressure in the interior of the earth 141 11990
—— The derivation of a formula for standard gravity, corresponding to Struve's terrestrial ellipsoid, with special reference to Spain 142 12130
See also under Sans Huelin, Guillermo.
Lundberg, Hans, Current trends and progress in mining geophysics 141 11996
—— Airborne electrical surveys for regional studies in oil and ore prospecting 143 12471
Lundberg, Hans, and Wilson, B. T., The airplane dominates in modern exploration methods 140 11810
Lundberg, H. T. F., and Zuschlag, Theodore, Arrangement for geophysical exploration, Austrian patent 142 12298
Lutz, J. P. *See* Franzén-Lutz, Britta.
Lutz, W., The rapid analysis of potassium deposits by gamma-radiation measurements using counters in horizontal drill holes underground 141 12064
—— Rapid analysis of solid and fluid samples containing potassium by measuring overground the gamma-radiation with a counter 141 12065
Lynch, J. J., An investigation of two-second microseisms associated with cold fronts and a new method for tracking the cold front center 142 12202
Lynn, R. D. *See* Ricker, Norman.

M

McCaslin, L. S., Jr., Sun completes base for geophysical operations 140 11799
McComb, H. E., Neumann, Frank, and Ruge, A. C., The determination of true ground motion from seismograph records 140 11715
McCormick, R. C. *See* under Poole, J. H. J.
Macdonald, G. A., and Orr, J. B., The 1949 summit eruption of Mauna Loa, Hawaii 143 12429
Macelwane, J. B., Survey of geophysical education in the United States and Canada in 1948 141 12002
—— Jesuit Seismological Association Twenty-fifth Anniversary Commemorative Volume 143 12370
McGaha, S. W., Radioactivity well logging moves north to Canada's fields 141 12073
McGee, D. A., Seale, Tom, and Finley, J. C., Oil in the Gulf of Mexico 141 12001

	No.	Abst.
McGuckin, Glenn M., Apparatus for solving seismic problems for location and dip of reflecting beds, U. S. patent	143	12487
McKim, V. C., The history of the seismological station at Fresno, Calif	140	11706
McKinney, R. U., Apparatus for seismic prospecting, U. S. patent	140	11871
Maclen, R. L. *See* under Goldin, A. S.		
Maecker, H., An analytical proof of the existence of boundary waves in optics	140	11712
Magnitskii, V. A., On the isolation of the local gravity anomalies	141	11923
—— Reductions of the gravity force	143	12344
Maher, J. C., and Jones, P. H., Ground-water exploration in the Natchitoches area, La	142	12275
Maienschein, Fred. *See* Jurney, E. T.		
Makino, Naofumi, On the apparent resistivity curves for underground layered structures	141	12052
Malmqvist, J. D. *See* under Lindblad, A. R.		
Malter, Lewis, Geiger-Müller counter for radioactive emission, U. S. patent	140	11895
Manfredini, Antonio, Geophysical investigation of gypso-sulfurous deposits in Sicily using electrical resistivity method	143	12466
Manley, J. H., Coincidence proportional counter, U. S. patent	143	12493
Maple, E., Bowen, W. A., and Singer, S. F., Measurement of the earth's magnetic field at high altitudes at White Sands, N. Mex	142	12156
See also under Singer, S. F.		
Marble, J. P., Accuracy of the lead method for the absolute measurement of geologic ages	140	11761
Marcelli, L. *See* under Caloi, Pietro, and Di Filippo.		
Marcuse, H., Uranium—Mineral of the future	140	11842
Martin, Hans. *See* Korn, H., Earthquakes in South-West Africa	143	12396
Martin, Jean, and Joset, Alain, Anisotropy of the velocity of seismic waves in the glaciers of Greenland	142	12179
Martin, P. W., Electrical well logging system, U. S. patent	140	11907
Martins da Silva, João. *See* de Andrade, Adalberto.		
Martner, S. T., Observations on seismic waves reflected at the core boundary of the earth	141	11950
Masarskii, S. I., The epicentral zone of the aftershocks of the earthquake in Ashkabad	143	12395
Matschinski, Mathias, Formation of continents and geodynamic forces	142	12223
Medi, Enrico. *See* under Giorgi, Maurizio.		
Medvedev, S. V., Measures against destructive effects of violent earthquakes	140	11744
Mei, A. I. *See* Byerly, Perry.		
Melchior, P. J., On the influence of the distribution of density in earth's interior on the luni-solar variations of gravity at a point	143	12346
Melchiori, G., Geomagnetic investigations of sedimentary iron ore deposits at La Nurra, Sardinia	141	12016
Menis, S., and Morelli, Carlo, Contribution to the study of the so-called "principal phase" of a seismogram	142	12181
Mercier, V. J., Well logging in limestone areas, radioactive vs. electrical	140	11846
—— Radioactivity logs don a "new look"	140	11853
Merten, Eugene, Hydrophone, U. S. patent	140	11872
Metzger, A. A. T., Contributions to the question of electric exploration of Quaternary deposits	140	11837
Meunier, Marcel, Apparatus for examination of materials by elastic waves, U. S. patent	141	12081
Mihailović, Jelenko, The seismicity of the Balkan Peninsula	142	12191
Millington, J. W. *See* Henson, R. L. Jr.		
Milne, W. G., Bibliography of seismology	140	11705
Milne, W. P., Relation of electric log resistivities in limestone to oil production	141	12071
Milosavlević, R. A., Seismologic characteristics of the Jastrebac region	143	12392
Mims, R. L. *See* under Hughes, D. S.		
Minakami, Takeshi, Recent activities of volcano Usu	143	12433
Minakami, Takeshi and Sakuma, Shuzo, The earthquake motions on various formations of the earth's surface	143	12404
Mintrop, Ludger, Economic and scientific value of geophysical methods in exploration of geologic formations and deposits of minerals	140	11788
Mironov, A. T., Electrodes for electrical measurements in sea water	141	11965
Modriniak, N., Geophysical investigation of Rotorua	142	12250
Molard, Pierre. *See* Coulomb, Jean.		
Molloy, E. W., and Hinch, W. W., Radiation alarm and measurement device, U. S. patent	140	11887
Monges Lopez, Ricardo, Geophysical Institute of Mexico	141	12003
Montandon, Frédéric, On the seismic waves of the Valais earthquake of 1946	140	11724
Moore, A. F. *See* under Runcorn, S. K.		
Morelli, Carlo, On the revision of standards in gravity measurements	140	11688
—— Latest data in favor of a correction to gravity values	140	11689
—— Study of submarine explosions in the Gulf of Trieste	140	11732

	No.	Abst.
Morelli, Carlo, The age of the earth	140	11762
—— The geoid and geophysics	142	12126
—— New criteria in magnetic investigations	143	12360
—— Comparison of the microseisms registered at Rome and at Trieste	143	12411
Morelli, Carlo, and d'Henry, G., Causes of microseisms	140	11740
See also under Giorgi, Maurizio, and Menis, S.		
Morris, George, Some considerations of the mechanism of the generation of seismic waves by explosives	141	12026
Morris, W. L., Apparatus for determining the permeability of cores, U. S. patent	142	12319
Morrow, G. R., Vibratory assembly for galvanometers, U. S. patent	142	12321
Morrow, M. E., Galvanometer, U. S. patent	142	12322
Morton, G. A., Scintillation type radiation detector and coincidence circuit therefor, U. S. patent	142	12304
Mott, P. G., Aerial surveying, applications in petroleum exploration and exploitation, pts. 1-2	140	11860
Mukhina, G. V., The screening effect of conductive layers	143	12460
See also under Tikhonov, A. N.		
Müller, Max, An accurate time recorder with decimal subdivision of frequencies for the recording of time and measurement of frequency	141	12075
—— The method of rotating electrodes placed crosswise	142	12274
Müller-Deile, G., Seismic reflection measurements on the sandbanks near Cuxhaven	142	12265
Murashita, Toshio. *See* Kurata, Nobuo.		
Murphy, L. M., United States Earthquakes, 1947	143	12389
Murphy, Thomas. *See* under Torreson, O. W.		
Muskat, Morris, Parker, F. W., and Kehl, W. L., Apparatus for perforating well casings and well walls, U. S. patent	140	11900
Myers, J. O. *See* Whetton, J. T.		
N		
Nagata, Takeshi, Summary of the geophysical investigations on the great earthquake in southwestern Japan on December 21, 1946	140	11725
Nagata, Takeshi, and Akimoto, Syun'iti, Magnetic transition points of volcanic rocks	143	12363
Nagata, Takeshi, Hirao, Kunio, and Yoshikawa, Haruou, Remanent magnetization of "Pleistocene" deposits—Paleomagnetism in Japan	143	12365
Nagata, Takeshi, and Okada, Atsushi, Land deformation of Muroto Point before and after the Nankaido great earthquake on Dec. 21, 1946	141	11959
Nakabayashi, Kazutaka, Generating mechanisms of spontaneous polarization: (2) Some examples in Manchuria	141	12056
Nasu, Nobuji, Strong motion vibrograph	143	12378
—— Block movement along the seismic fault	143	12397
Nathan, Hans, Geological findings from exploratory drilling for oil in the Bavarian Innviertel	142	12219
Nedeljković, R. L., The seismicity of Banat	142	12192
Neil, Hugh G., Radiation detector, U. S. patent	142	12301
Nel, L. T., Simpson, D. J., and DeVilliers, John, Modern methods of mineral exploration in South Africa	140	11796
Nesbitt, R. H., The work of the geologist in civil engineering	142	12256
Neufeld, Jacob, Radiation measurement and instrument testing, U. S. patent	142	12302
Neumann, Frank. *See* McComb, H. E.		
Newsom, E. G., Time interval measuring device, U. S. patent	141	12124
Nichols, P. B., Geolograph aids drilling operations	140	11857
Nicolson, A. M., Method and apparatus for detecting waves, U. S. patent	140	11873
Niem, G. de, Electrical and magnetic field of a point source	141	12045
Niggli, Ernst. *See* Weber, E. K.		
Nishimura, Eiichi, On earth tides	141	11913
Niskanen, Erkki, On the elastic resistance of the earth's crust	141	11914
—— On the viscosity of the earth's interior and crust	141	11915
Noetzlin, J., Balances of energy in geophysics	143	12437
Norelius, R. G., Improved radioactivity logging for California	140	11854
Norelius, R. G. *See* under Stick, J. C., Jr.		
Norges Geografiske Oppmålings virksomhet, Norway Geogr. Survey activity. Annual report for 1949	143	12350
Norinder, Harald, and Salka, Oskars, The effect of geological discontinuities on artificial lightning discharges as studied in a model test arrangement	143	12413
Null, F. E., Stabilized vertical pendulum, U. S. patent	141	12078

O

No. Abst.
Ochiai, Toshiro. *See* under Kurata, Nobuo.
Offner, Franklin, Locating device, U. S. patent 142 12328
Oil, Gulf's airborne magnetometer may revolutionize oil exploration 140 11809
Okada, Atsushi. *See* under Nagata, Takeshi.
Ol', A. I., Microseisms and solar activity 141 11962
Olczak, Tadeusz, Measurements with the Eötvös torsion balance and the problem of determining the higher normal derivatives of the external gravity potential 143 12445
Oliphant, C. W., Comparison of field and laboratory measurements of seismic velocities in sedimentary rock 142 12177
Olson, R. W., Seismograph compositing system 141 12083
Omer, G. C., Jr., Volcanic tremor 143 12427
Omote, Syun'itiro, Earthquake damages in Yokohama City due to the great Kwanto earthquake of September 1, 1923 .... 143 12400
—— The relation between the earthquake damages and the structure of ground in Yokohama. 143 12401
Oñate Espinosa, Roberto, Geophysical investigations in the Veracruz region 142 12244
Orr, J. B. *See* Macdonald, G. A.
Oszlaczky, Szilárd, Gravitational action of a two-dimensional parallelepiped, measurable by the torsion balance in the vertical plane 140 11686
Oulianoff, Nicolas, Seismology and the structure of the sub-basement of the Alps 140 11726
—— Problems of superposed tectonics and geophysical methods 140 11774
—— Commentary on the results obtained from the leveling of the region Sierre-Montana-Sion, made as a result of the earthquake of January 25, 1946 .... 143 12398

P

Pacella, G. B., Gravity measurements in Ethiopia 141 11933
Pajari, Yrjo. *See* Trotter, Charles.
Pamir, H. N., A seismotectonic line in northern Anatolia 141 11960
Pannocchia, G. *See* under Caloi, Pietro.
Parker, F. W. *See* under Muskat, Morris.
Parker, G. G., and Stringfield, V. T., Effects of earthquakes, trains, tides, winds, and atmospheric pressure changes on water in the geologic formations of southern Florida 142 12198
Parr, J. O., Jr., Apparatus for separation of blasting-circuit leads, U. S. patent 143 12484
Paul, Bernt, Geoelectrical measurements by the Schlumberger method on the surface of the ground and in drill holes 142 12268
Paver, G. L., The geophysical investigation of underground water supplies 143 12467
Perlow, G. J., Shipman, J. D., Jr., and Schroeder, C. A., Radioactivity detector, U. S. patent 142 12299
Peronaci, Francesco, Determination of the average thickness of the granitic layer between Turkestan and Europe 143 12385
Perret, F. A., Volcanological observations 141 11974
Perret, W. R., Electrical resistivity exploration as a complement to boring in deep alluvial deposits 140 11838
Petroeschevsky, W. A., and Klompé, Th. H. F., Volcanological investigations in Indonesia 143 12432
Petroleo Interamericano, Surface seismic shooting 140 11824
Petroleum, The airborne magnetometer 140 11811
Petroleum World, Sea-borne seismic work under way off California coast 140 11828
Petrova, G. N., Interior demagnetizing factor 140 11696
Petrucci, G., Importance of the analysis of the variation of the electrical field in prospecting by the self-potential method 140 11834
Pettersson, Hans, Exploring the bed of the ocean 140 11781
—— Exploring the ocean floor 142 12186
Pettijohn, F. J. *See* Good, S. E.
Picciotto, Edgard, Study of the radioactivity of samarium by the photographic method 140 11754
Pivovarov, C. P., An amplifier for very low frequencies 143 12477
Plesset, E. H., Magnetic flux measuring apparatus, U. S. patent 141 12079
Poisson, Charles, Terrestrial magnetism in Madagascar 142 12159
Poldini, E., Tectonic meaning of the variations of the telluric field 142 12205
Pontecorvo, Bruno, Method of geophysical prospecting, U. S. patent 141 12092
Poole, J. H. J., Delaney, C. F. G., and McCormick, R. C., The possible existence of a fourth natural radioactive series 140 11753
Pough, F. H., The geologic history of Parícutin 141 11976
Poulter, T. C., The Poulter method of geophysical exploration 141 12034
—— The Poulter seismic method 141 12035

No. Abst.

Powell, C., Radio aids to oil exploration 140 11864
Pregel, Boris. *See* Blau, Marietta.
Pregel, Boris. *See* Goldstein, Ladislas.
Press, Frank, and Ewing, Maurice, Propagation of explosive sound in a liquid layer overlying a semi-infinite elastic solid 142 12170
Press, Frank, Ewing, Maurice, and Tolstoy, Ivan, The Airy phase of shallow-focus submarine earthquakes 141 11953
See also under Ewing, Maurice.
Price, W. J., and Huntington, H. B., Acoustical properties of anisotropic materials 140 11711
Princep Curto, J. M., A cycle of magnetic bays from the records of the Ebro Observatory 141 11940
Pringle, R. W., A portable scintillation spectrometer 142 12278
Purdy, W. G. *See* under Bender, W. W., Jr.

Q

Quarles, Milton, Jr., Fault interpretation from seismic data in southwest Texas 142 12262
Querzoli, Ruggero. *See* Ageno, Mario.

R

Raggatt, H. G., Depletion of mineral resources—A challenge to geology and geophysics 141 11997
Raitt, R. W., Studies of ocean-bottom structure off southern California with explosive waves 140 11733
Ramachandra Rao, M. B., Geophysical prospecting methods 142 12241
Ramirez, J. E., New seismic station at Galerazamba, Colombia 140 11707
——— The new seismic station at Galerazamba, Colombia 141 11943
Ramsey, W. H., On the compressibility of the earth 141 11984
——— On the nature of the earth's core 141 11985
Ramspeck, Adolf, and Schulze, G. A., Vibration studies on simple masonry bodies and buildings 142 12266
Rathkamp, W. R., Fluxmeter, U. S. patent 143 12480
Ray, H. W., Radioactivity well logging proves effective in the northern Colorado-southern Wyoming area 141 12072
Rayner, J. M., Preliminary geophysical report on the southern extension of the main line of lode, Broken Hill 143 12451
Redding, V. L. *See* under Slotnick, M. M.
Reich, Hermann, Geophysical problems in the Bavarian-Schwäbian Danube basin 140 11777
——— Geophysical map of northwestern Germany 140 11780
——— Geological results of the seismic observations of the Helgoland explosion 142 12185
Reichertz, P. P., Method for measuring extent of oil saturation of porous materials, U. S. patent 142 12307
Reynolds, G. T., Liquid scintillation counters 141 11968
Rice, R. B., A discussion of steep-dip seismic computing methods 141 12038
Richards, T. C. *See* under Bemrose, John.
Ricker, Norman, and Lynn, R. D., Composite reflections 141 12033
Rikitake, Tsuneji, Magnetic anomalies and the corresponding magnetic centres 143 12364
——— A method for studying the relations between the changes in geomagnetism and earth current 143 12412
——— A note on the temperature distribution within the earth 143 12425
Riznichenko, Ю. V., Seismic quasi-anisotropy 140 11710
Roberts, A., Portable Geiger counter for drill holes 142 12285
Roberts, E. B. and Ulrich, F. P., Seismological activities of the U. S. Coast and Geodetic Survey in 1948 143 12369
Roche, Alexandre, The magnetic characters of the Gergovie eruptive rocks 140 11702
——— Magnetic anomalies associated with peperino massifs in Limagne, Auvergne 142 12163
Rodgers, John, Mechanics of Appalachian folding as illustrated by Sequatchie Anticline, Tennessee and Alabama 142 12227
Rodriguez Aguilar, Manuel, Exploration problems in Mexico 142 12243
Rogozinski, A. *See* under Lesage, M.
Rohrer, E. R. *See* under Goldin, A. S.
Rohrer, R. H., A portable high-speed Geiger counter for geologic work in Georgia 142 12208
Rolshausen, F. W., and Swain, S. E., Coring and fluid sampling device, U. S. patent 141 12105
Romberg, Frederick, Prospecting with gravimeter reveals the presence of minerals 140 11801
Romney, Carl. *See* under Byerly, Perry.
Romslo, T. M. *See* under Cummings, J. B.
Rooney, W. J., Earth-current results at Tucson Magnetic Observatory, 1932–42 140 11745
See also under Tuve, M. A.
Rosini, E. *See* Giorgi, Maurizio.
Rossi, B. B., and Allen, J. S., Radiation measurement, U. S. patent 141 12090
Rostoker, Normon. *See* under Gilchrist, Lachlan.

	No.	Abst.
Rothé, Jean, Earthquakes and volcanoes	142	12165
Rothersberger, Hans. *See* under Weber, E. K.		
Röthlisberger, Hans, Measurement of the velocity of elastic waves in sandstone	143	12381
Rouaud, André, Determination of the constants of electromagnetic seismographs	140	11714
Roubault, Marcel, The origin of mountains	140	11772
Rubenstein, J. H., Magnetometer, U. S. patent	140	11869
Ruge, A. C. *See* under McComb, H. E.		
Rumbaugh, L. H., and Alldredge, L. R., Airborne equipment for geomagnetic measurements	140	11808
Rummerfield, B. F., Certain problems in seismological exploration in Mexico	143	12456
Runcorn, S. K., Benson, A. C., and Moore, A. F., The experimental determination of the geomagnetic radial variation	142	12155
Russell, W. L., Method and apparatus for well logging. U. S. patent	143	12500
Rutherford, V. S. and English, J. F., Bolometer, U. S. patent	143	12497
Rutten, L. M. R., Frequency and periodicity of orogenetic movements	140	11773

S

	No.	Abst.
Sakuma, Shuzo, The earthquake motions on various formations of the earth's surface	143	12405
Sakuma, Shuzo. *See* Minakami, Takeshi.		
Sala, I. *See* under Heiskanen, W.		
Salisbury, W. W., Method and apparatus for producing neutrons, U. S. patent	140	11881
Salka, Oskars. *See* Norinder, Harald.		
Sans Huelin, Guillermo, and Lozano Calvo, Luis, Gravity determinations in Spain and the best reference ellipsoid derived from these data	141	11929
——— Network of gravimetric observations in the Provincia de Segovia	141	11930
Santangelo, M. *See* Festa, C.		
Sato, Konosuke, On the "mean" 3-electrode method	141	12055
Sato, Yasuo, Possibility of optical explanation of visible wave motion of ground	143	12399
——— Relation between seismic intensity and epicentral distance	143	12402
Savarenskiĭ, E. F. and Kirnos, D. P., The elements of seismology and seismometry	143	12373
Savitt, C. H., Reflected energy variations resulting from small changes in shot hole and spread locations	141	12027
Schad, Albert, Stratigraphic interpretation of electric well logs	143	12476
Schaufelberger, W. M. *See* Merrick, H. N.		
Schenk, Erwin, The importance and the interpretation of discontinuities in diagrams obtained in geoelectrical deep exploration	141	12049
——— On the influence of boundaries between layers on vertical electrical soundings	141	12050
Scherbatskoy, S. A., Transmitting of information in drill holes, U. S. patent	141	12102
——— Seismic exploration by means of periodic excitation, U. S. patent	142	12296
Schleusener, Alfred, The limits of precision in determinations of average rock density by gravimetric measurements	141	11924
——— Principles of the extended regional gravitational survey of the Amt für Bodenforschung	142	12140
Schmidt, E. R., Geomechanics of the earth's crust	140	11771
Schmitz, H. P., Interpretation of earth-current measurements	142	12204
Schoff, S. L., Seismograph shooting and water wells	141	12021
Scholte, J. G., On true and pseudo Rayleigh waves	141	11946
Schonstedt, E. O., and Irons, H. R., Airborne magnetometer for measuring the earth's magnetic vector	142	12251
Schroeder, C. A. *See* under Perlow, G. J.		
Schulze, G. A., and Förtsch, Otto, Seismic observations during the explosion on Helgoland on April 18, 1947 for the exploration of the crust	143	12386
Schulze, G. A. *See* Ramspeck, Adolf.		
Schumann, H., The spatial variation of the form of pores in rocks	142	12288
Seivally, H. R., Well-logging recorder, U. S. patent	143	12506
Seaborg, G. T. *See* under Curtiss, L. F.		
Seale, Tom. *See* under McGee, D. A.		
Segre, Emilio G., and Chamberlain, Owen, Ionization chamber, U. S. patent	142	12309
Seigel, H. O., A theory of fracture of materials and its application to geology	142	12233
Selenyi, P., Galvanometers with photoelectric feedback	142	12290
Sellien, K., A diagram for the determination of the effect of given irregularly shaped masses on the intensity of gravity	143	12448
Semenov, A. S., The theory of the method based on charged bodies applied to equipotential conductors	141	12046
Sergeev, M. N., Potential produced by an elliptic lamina of negligible thickness	143	12340

No. Abst.
Sewell, B. W., Core barrel, U. S. patent 140 11901
Sezawa, Katsutada, and Kanai, Kiyoshi, On the propagation of Rayleigh waves in dispersive elastic media 142 12172
—— On the initial movement of a seismograph subjected to an arbitrary earthquake motion, solved with operational calculus, pt. 2 142 12176
Shamos, M. H., Geiger-Müller counter, U. S. patent 142 12310
Shereshevskaia͡, S. I͡A. *See* under Bogdanov, A. A.
Shibata, B. *See* under Kiyono, Takeshi.
Shimek, E. J., Seismograph gain control system, U. S. patent 140 11875
Shipman, J. D., Jr. *See* under Perlow, G. J.
Shivers, P. F., Gravity sensitive variable inductance device, U. S. patent 142 12320
Shock, Lorenz, The progressive detonation of multiple charges in a single seismic shot 141 12028
Shockley, William, Differential altimeter, U. S. patent 141 12122
Shore, L. G., Geiger counter and gas atmosphere therefor, U. S. patent 141 12087
Siegert, A. J. F., and Watt, B. E., Radioactive borehole logging, U. S. patent 141 12100
Silverman, Daniel, Shield for well logging instruments, U. S. patent 140 11904
—— Fluid ingress well logging, U. S. patent 142 12318
—— Interface locator, U. S. patent 143 12501
—— Elevation-recording apparatus, U. S. patent 143 12508
Silverman, Daniel, Eisler, J. D., and Evans, J. F., Correcting pendulum grade-angle measurements, U. S. patent 141 12112
—— Pendulum system for grade-angle measurements, U. S. patent 141 12113
Simon, R. F. *See* Clewell, D. H.
Simpson, D. J. *See* under Nel L. T.
Singer, S. F., Maple, E., and Bowen, W. A., Jr., Measurement of the earth's magnetic field at high altitudes at White Sands, N. Mex 140 11698
See also under Maple, E.
Skeels, D. C., Geophysical data on the North Carolina Coastal Plain 142 12144
Skellett, A. M., Detector for high energy radiation, U. S. patent 140 11889
Slack, H. A., Radioactivity measurements in the Kirkland Lake area, northern Ontario 140 11766
Slätis, Hilding, Experiments in the possibility of increasing the efficiency of gamma-counters 141 11967
Slaucitajs, Leonids, Geomagnetic anomalies in the regions surrounding the Baltic Sea 140 11700
Slotnick, M. M., A graphical method for the interpretation of refraction profile data 141 12036
Slotnick, M. M., Brooks, J. A., Jr., and Redding, V. L., Note on well-shooting data and linear increase of velocity 143 12454
Smith, B. W., Projection-vibration indicator, U. S. patent 143 12513
Smith, E. M., Temperature responsive measuring apparatus, U. S. patent 141 12098
Smith, N. J., The case for gravity data from boreholes 143 12446
Smulski, T. J., Electrical instrument, U. S. patent 142 12325
—— Electrical instrument, U. S. patent 142 12326
—— Electrical instrument, U. S. patent 142 12327
Snyder, T. M. *See* Stauffer, L. H.
Solaini, Luigi. *See* Aliverti, Giuseppina.
Spicer, H. C., Investigation of bedrock depths by electrical resistivity methods in the Ripon-Fond du Lac area, Wis 141 12058
Spradlin, V. E., The relation of the initial production to true resistance in the Southeast New Castle field, Cleveland and McClain Counties, Okla 141 12070
Stauffer, L. H., and Snyder, T. M., Neutron meter, U. S. patent 141 12091
Stead, F. W., Prospecting for uranium with portable Geiger-Müller equipment 141 12061
—— Equipment for uranium prospecting 142 12281
—— Airborne radioactivity surveying speeds uranium prospecting 142 12282
Steenland, N. C. *See* under Ewing, Maurice.
Stein, J. H., Magnetic field angular gradientometer, U. S. patent 140 11868
Steinmueller, R. E. *See* under Dietert, H. W.
Stenz, Edward, First magnetic determinations in Afghanistan 141 11939
Stick, J. C., Jr., Baker, J. S., and Norelius, R. G., New electrical logging techniques in California 140 11844
Stoneley, Robert, The effect of a low-velocity internal stratum on surface elastic waves 141 11944
Stratton, E. F. *See* under Doll, H. G.
Stringfield, V. T. *See* Parker, G. G.
Stripling, A. A., Broding, R. A., and Wilhelm, E. S., Elevation surveying by precision barometric means 140 11863
Subkow, Philip, Geometrical determination of dip and strike of cored strata, U. S. patent 140 11905
Sucksdorff, E., On geomagnetism and the aurora borealis in the light of recent research 141 11936
Sulkowski, E. I., The University of Pittsburgh pen-and-ink recording seismograph 143 12376

No. Abst.

Sullivan, C. J., Mineral exploration in Australia 140 11797
Sundquist, K. J. *See* Werner, P. W.
Swain, S. E. *See* Rolshausen, F. W.
Swallow, J. C. *See* Hill, M. N.
Sweet, R. C., Gravimeter, U. S. patent 142 12292
Swift, Gilbert, Fearon, R. E., and Thayer, J. M., Neutron log, U. S. patent 142 12316
See also under Fearon, R. E., and Thayer, J. M.
Szalay, A., and Csongor, Eve, Determination of radioactive content of rocks by means of Geiger-Müller counters 142 12213

T

Taborda, B. A., Remarks on geologic exploration for petroleum 143 12440
Tainsh, H. R., Tertiary geology and principal oil fields of Burma 141 12069
Takahashi, Ryutaro, and Hirano, Kintaro, A new horizontal-component seismograph for comparison observations 140 11713
Takeuchi, Hitoshi, On the earth tide of the compressible earth of variable density and elasticity 143 12343
Takubo, Jitsutaro, Experiments on the dielectric constants of some minerals and on the variation of their dielectric properties due to heating 140 11746
Tanni, L. I., On the continental undulations of the geoid as determined from the present gravity material 141 11916
—— The regional rise of the geoid in Central Europe 141 11917
Tarczy-Hornoch, A, Adjustment of gravity gradients 140 11687
Tartakovskii, B. D., On the theory of propagation of plane waves through homogeneous strata 141 12022
Tatel, H. E., Argon ^{40} and the age of the earth 143 12419
Tercedor, Mariano, Seismotectonic invesgiation of lowland of Granada 143 12391
Texas Oil Journal, New method of seismic exploration may cut costs and speed search for new oil 140 11825
Thayer, J. M., Fearon, R. E., and Swift, Gilbert, Method and apparatus for producing neutron logs of drill holes, U. S. patent 142 12314
Thayer, J. M., Swift, Gilbert, and Fearon, R. E., Method and apparatus for neutron well logging, U. S. patent 142 12315
See also under Fearon, R. E., and Swift, Gilbert.
Thirlaway, H. I. S., and Cook, A. H., Recent observations of gravity in Wales and the Borders 140 11692
Thomeer, J. H. M. A., Radioactivity of sedimentary rocks as an aid in the investigation of boreholes in petroleum exploration 143 12473
Thommeret, J., Determination of the uranium content in radioactive substances 140 11757
Thompson, J. B. *See* Hurley, P. M.
Thompson, R. R., Electrical-prospecting method, U. S. patent 143 12450
Thomson, J. E., Geology of the main ore zone at Kirkland Lake 141 11973
Thomson, W. T., Transmission of elastic waves through a stratified solid medium 142 12171
Tikhonov, A. N., On the transient of an electric pulse in an unhomogeneous stratified semispace 142 12271
—— Determination of electrical properties of deep strata of the earth's crust 143 12414
Tikhonov, A. N., and Mukhina, G. V., Determination of alternating electrical field in a stratified medium 141 12047
Tillotson, Ernest, Seismology in Britain 140 11708
Tiratsoo, E. N., Radioactivity well logging 140 11847
—— The radioactivity of sediments, pts. 1–4 142 12214
—— Radioactivity survey in southwest France 142 12215
Tittle, C. W., Goodman, Clark, and Faul, Henry, Nuclear radiation in well logging 140 11849
See also under Faul, Henry.
Tobien, H., The correlation of Schlumberger logs in the lower Tertiary of northwestern Germany 143 12475
Tolstoy, Ivan, and Ewing, Maurice, North Atlantic hydrography and the Mid-Atlantic Ridge 140 11782
—— The *T* phase of shallow-focus earthquakes 141 11951
See also under Ewing, Maurice, and Press, Frank.
Torreson, O. W., Murphy, Thomas, and Graham, J. W., Magnetic polarization of sedimentary rocks and the earth's magnetic history 140 11703
Tow, J. O., Gun perforator, U. S. patent 141 12104
Trappe, F., and Zettel, W., A new type electrical seismograph for field use 141 12023
Trefethen, J. M., Geology for engineers 140 11789
Trotter, Charles and Pajari, Yrjo, Time-locking instrument for surveying inclination and direction of bore-holes, U. S. patent 141 12103
Truesdell, C., On the effect of a current of ionized air upon the earth's magnetic field 143 12356
Tschu, K. K., On the practical determination of lunar and luni-solar daily variations in certain geophysical data 140 11699

No. Abst.

T͡Simbalin, V. V. *See* under Konakhovich, I͡U, I͡A.
Tsuboi, Chuji, Thickness of the isostatic earth's crust in vairious parts of the United States of America 143 12348
Tsubokawa, Ietsune, A new type magnetometer 143 12359
Tsung, F. T., The average specific gravity of the geological formations in Taiwan 141 11925
Tsung, F. T. *See* Chao, J. S.
Tuve, M. A., Goranson, R. W., Greig, J. W., and Rooney, W. J. Progress report on studies of deep crustal layers by explosive shots 143 12387

U

Uemura, Yoshiaki. *See* Kimura, Kiichi.
Ulrich, F. P. *See* Roberts E. B.
U. S. Geological Survey, Total intensity aeromagnetic maps of Indiana 140 11816
142 12253
—— Total intensity aeromagnetic maps of Minnesota 140 11817
—— Total intensity aeromagnetic maps of Missouri 140 11818
142 12254
U. S. Waterways Experiment Station, Critical study of shallow seismic exploration in the limestone areas of the Ozark Highlands 141 12040
——, Seismic and resistivity exploration methods 141 12041
Uzelač, Miroslava, Seismic characteristics of the Srem region 142 12193

V

Valderrama Suárez, Mariano, Earthquake proof constructions 143 12406
Valle, P. E., Interpretation of seismograms between 80° and 120° 140 11723
—— Influence of internal friction on the propagation of Love waves 142 12173
——— Determination of the group velocity of surface waves 142 12174
—— Contribution to the study of Love waves 143 12374
Vassy, Etienne, Device for comparing with a common physical receiving means, two radiations of similar character and subsidiarily recording the ratio between said radiations, U. S. patent 141 12095
Vening Meinesz, F. A., Earth's crust deformations in geosynclines 142 12224
—— Gravity expeditions at sea 1923-1938 .... 143 12354
Vincent, R. P., Well-logging apparatus, U. S. patent 143 12499
Vladimirov, A. T., with Zen'kovich, V. P., Recent sinking of the coast of western Kamchatka 142 12230
Vlodavets, V. I., The volcanoes of the Soviet Union 141 11977
Vogelsang, C. A., Temperature responsive measuring apparatus, U. S. patent 141 12099
Voisin, A. *See under* Lesage, M.
Voit, H., The optimum dimensions of the bifilar gravimeter 143 12347
Volet, Charles, The measurement of gravity 141 11911
Volk, J. A., The photoelectric seismograph 143 12377
—— Microseismic arc light timer 143 12380

W

Wadia, D. N., The aid of geophysics in mineral exploration in India 142 12242
Wails, W. C., Rock-coring method, U. S. patent 141 12107
Walters, R. C. S., Some geophysical experiences in water supply 143 12469
Wanner, E., Seismic noise 140 11742
Wannier, G. H., Method and apparatus of measuring the activity of radioactive materials, U. S. patent 141 12086
Wasiutynski, Jeremi, The surface history of the earth in the light of planetary dynamics 140 11769
Wasserfall, K. F., A study of the secular variation of magnetic elements based on data for *D*, *I*, and *H* for Oslo, 1820-1948 .... 143 12361
Watson, R. J. *See* under Bemrose, John.
Watt, B. E. *See* Siegert, A. J. F.
Weaver, Paul, Variations in history of continental shelves 142 12228
Weber, E. K., Gassmann, Fritz, Niggli, Ernst, and Rothersberger, Hans, The magnetic anomaly west of Locarno 142 12164
See also under Gassmann, Fritz.
Weiss, Oscar, Aerial magnetic survey of the Vredefort Dome in the Union of South Africa 140 11819
Weisz, P. B., Geiger-Müller counter tube, U. S. patent 142 12308
Weng, W. P., The application of gravity exploration in Taiwan 142 12247
Werner, P. W., and Sundquist, K. J., On hydrodynamic earthquake effects 142 12199
West, S. S., Dependence of seismic wave velocity upon depth and lithology 143 12382

	No.	Abst.
West, W. D., General report of the Geological Survey of India for the year 1948	143	12443
Western Miner, New use for Geiger counter	140	11840
—— Aerial survey	140	11861
Whetton, J. T., and Myers, J. O., Application of electrical-resistivity measurements to the location of coal seams at shallow depth	143	12465
White, D. E., and Brannock, W. W., The sources of heat and water supply of thermal springs, with particular reference to Steamboat Springs, Nev	142	12218
White, W. C., and Yagoda, Herman, Abundance of N^{15} in the nitrogen occluded in radioactive minerals	142	12211
Wiegand, C. E. *See* under Kennedy, J. W.		
Wier, K. L., Comparisons of some aeromagnetic profiles with ground-magnetic profiles	141	12014
See also under Balsley, J. R.		
Wijk, A. M. van. *See* under Hales, A. L.		
Wilhelm, E. S. *See* under Stripling, A. A.		
Williams, A. L. W., Electro-mechanical transducer, U. S. patent	140	11878
Williams, David. *See* Jones, W. R.		
Williams, F. J., Coupling means for seismometers, U. S. patent	140	11880
Williams, Howel, Volcanoes of the Parícutin region, Mexico	143	12430
Willmore, P. L., Seismic experiments on the North German explosions, 1946 to 1947	140	11734
Wilson, B. T. *See* Lundberg, Hans.		
Wilson, J. Tuzo, Recent applications of geophysical methods to the study of the Canadian Shield	140	11776
—— Some major structures of the Canadian Shield	142	12225
Wilson, V. C., Radiation counter, U. S. patent	142	12306
Winter, A. B. *See* Campbell, J. L. P.		
Wolf, Alexander, Seismic exploration system for determination of strata dips, U. S. patent	140	11877
Woo, C. C., Some improvements in La Cour's quartz torsion horizontal intensity magnetometer	141	11938
Woodward, M. E., Oil wells with new life through radioactivity logs	140	11855
Woollard, G. P., Regional gravity study of the Appalachian Mountain system	140	11693
—— Report of the special committee on the geophysical and geological study of continents, 1948–49	140	11775
—— The gravity meter as a geodetic instrument	141	11920
World Petroleum, New method of seismic exploration for oil	140	11826
—— New system aids marine surveys	140	11865
Worzel, J. L. *See* Ewing, Maurice.		
Wright, H. O., Pulse-reflection distance-measuring system, U. S. patent	141	12116
Wulf, O. R., and Hodge, M. W., On the relation between variations of the earth's magnetic field and variations of the large-scale atmospheric circulation	142	12154
Wyckoff, R. D., Method and apparatus for measuring magnetic fields, U. S. patent	142	12293
Wyllie, M. R. J., Statistical study of accuracy of some connate-water resistivity determinations made from self-potential log data	140	11845

Y

	No.	Abst.
Yagoda, Herman. *See* White, W. C.		
Yale, M. V., Geophysics as a factor in the oil industry	140	11790
Yancey, J. R. *See* Denning, C. O.		
Ylanan, C. W., The northern Luzon earthquake December 29, 1949	142	12197
Ylinen, J., Relationship between microseisms and weather	141	11964
Yoshikawa, Haruo. *See* under Nagata, Takeshi.		
Yüngül, Sulhi, Interpretation of spontaneous polarization anomalies caused by spheroidal bodies	141	12048

Z

	No.	Abst.
Zanon, F. S., Microseisms produced by meteorological factors	140	11741
Zen'kovich, V. P., and Vladimirov, A. T., Recent sinking of the coast of western Kamchatka	142	12230
Zerna, W. *See* Green, A. E.		
Zettle, W. *See* Trappe, F.		
Zietz, Isidore. *See* Henderson, R. G.		
Ziloff, Wladimir, Obtaining of continuous logs and their interpretation in view of the completion of exploratory drill holes	142	12283
Zuschlag, Theodore, Apparatus for detecting magnetic disturbances, U. S. patent	142	12294
See also under Lundberg, H. T. F.		
Zwerger, Rudolf von, Deeper underground structure of the western Peribaltic—A contribution to the interpretation of the regional gravitational and geomagnetic anomalies	140	11778

SUBJECT INDEX, 1950

	Author	Abstract
Accelerometer, Brush, calibration	Honnell	12478
crystal	Gassmann	12375
Acoustic properties of anisotropic materials	Price	11711
Acoustic waves, reflection from stratified media	Brekhovskikh	12167
Aerial photomapping	Western Miner	11861
Afghanistan, magnetic declination at Kabul	Stenz	11939
Age determinations, accuracy of lead method in	Marble	11761
by helium method	Hurley	11765
by Pb/U ratio	Guimaraes	12210
by strontium method	Ahrens	11759
correlation with structural trends	Hurley	11763
in unconsolidated ocean sediments	Kulp	11758
of the earth	Morelli	11762
of the earth, Argon ^{40} and the	Jeffreys	12209
	Tatel	12419
lead isotopes and	Holmes	12212
recent data on	Ippolito	12420
radioactive methods	Hurley	11760
Airborne electromagnetic surveys	Lundberg	11810
Airborne magnetic survey, Allard Lake district, Quebec	Bourret	11814
Bahama Islands	Bemrose	12013
Baraga, Houghton, Iron Counties, Michigan	Balsley	11813
northwest Maine	Hurley	11815, 12252
Vredefort dome, S. Africa	Weiss	11819
Airborne magnetic surveying, techniques of	Petroleum	11811
Airborne magnetometer, AN/ASQ-3A	Rumbaugh	11808
for measuring magnetic vector	Schonstedt	12251
Gulf	Oil	11809
saturation	Cassinis	12012
Airborne radioactivity surveying	Stead	12282
Airy phase	Press	12170, 11953
Aleutians, volcanic activity in	Coats	12428
Algeria, gravity survey in	Lagrula	11932
Amplifier for low frequencies	Pivovarov	12477
Anatolia, earthquakes in	Pamir	11960
Anisotropic materials, acoustic properties	Price	11711
Alpine foreland, gravity, magnetic, seismic surveys in	Reich	11777
Alps, seismological interpretation of structure	Oulianoff	11726
	Montandon	11724
Andes, earthquake sequences in	Benioff	11735
Appalachian Mountains, magnetic surveying in	Branham	12010
mechanics of folding	Rodgers	12227
regional gravity survey	Woollard	11693
tectonics	King	12226
Arctic exploration conditions	Greenman	11793
Argon and the age of the earth	Jeffreys	12209
	Tatel	12419
Arizona, earth current measurements in	Rooney	11745
electrical surveys in Twin Buttes mine	Cummings	12470
Asbestos, aeromagnetic exploration for	Hurley	12252
Athabaska region, radioactivity measurements in	Brownell	12067
Atlantic Coastal Plain, seismic refraction surveys	Ewing	12188
Atlantic Ocean, bottom topography of	Tolstoy	11782
seismic refraction surveys	Ewing	11729, 11730, 12187
	Hill	11731
seismic surface-wave velocity in	Caloi	11954
structure of	Caloi	12384
submarine gravity surveys	Browne	11927
thickness of sediments in	Pettersson	11781
Australia, mineral exploration in	Sullivan	11797
Autoradiographic techniques	Coppens	12421
	Hée	12216, 12422, 12423
Azores, earthquake of Nov. 25, 1941	Di Filippo	11719, 11955
Bahama Islands, aeromagnetic survey of	Bemrose	12013
Balkan Peninsula, earthquakes in	Mihailović	12191
Baltic Sea, magnetic anomalies in	Slaucitajs	11700
Barometer as elevation meter	Stripling	11863
Belgium, regional gravity survey	Jones	11691
Bibliography of seismology, Jan.-June 1949	Milne	11705
Bicaram	Belluigi	12463
Bikini, aeromagnetic survey of	Alldrege	11812
bottom structure	Dobrin	12388
Boundary waves, existence of, on seismograms	Kanai	12383
analytical proof of, in optics	Maecker	11712
Brazil, Conselho nacional de petroleo report		12441
Burma, electrical logging in oil fields	Tainsh	12069
thermal gradient in oil fields	Tainsh	12069
California, electrical logging techniques	Stick	11844
Fresno seismological station	McKim	11706
ocean-bottom structure offshore	Raitt	11733
radioactivity logging in	Norelius	11854
seismic surveys offshore	Petroleum World	11828
Canada, exploration problems in western plains	Beck	11999
exploration statistics	Joubin	11795
gravity values at Goose Bay	Beer	12349
radioactivity logging in western oil fields	McGaha	12073

Author Abstract

- Canadian shield, geophysical investigations of ... Wilson 11776
  - major structures in ... Wilson 12225
- Capillary pressure and reservoir rocks Archie 11991
- China, electrical resistivity surveys, Laochunmiao oil field ... Chang 12057
  - gravity survey, Shanghai ... Chao 11934
  - isostatic anomalies in ... Ku 12148
  - magnetic survey, Pehpei district ... Chen 11941
- Coal, electrical resistivity surveys for Whetton 12465
  - gravity surveys for ... de Sitter 12246
  - magnetic surveys for ... de Sitter 12246
- Colombia, Galerazamba seismograph station ... Ramirez 11707, 11943
- Colorado, heat flow in Front Range ... Birch 12217
  - radioactivity logging in ... Ray 12072
- Compass, anomalous behavior of, in Malaya ... Ingham 12450
- Compressibility in earth's interior ... Ramsey 11984
- Compressibility-pressure hypothesis of earth's interior Bullen 11981, 11982, 11983
  - Ramsey 11984
- Connate water, resistivity determination of ... Wyllie 11845
- Continental shelf, variations in history of ... Weaver 12228
- Continents, formation of ... Matschinski 12223
  - geophysical and geological study Woollard 11775
  - structure of crust in ... Gutenberg 11727
- Convection currents ... Bullard 11986
  - Elsasser 11987
  - Wasiutynski 11769
- Copper, electrical surveys for ... Cummings 12470
- Core, causes of motion in ... Elsasser 11987
  - composition of ... Hardtwig 12235
    - Kuhn 11736
    - Ramsey 11985
  - compressibility-pressure hypothesis of ... Bullen 11981
  - constitution of ... Bullen 11982
    - Ramsey 11984
  - dynamic effects of liquid ... Jeffreys 11989
  - magnetic effects of motion in ... Bullard 11935
  - shear-wave velocity in ... Bullen 11982
  - transfer of heat from ... Bullard 11986
- Crust, elastic resistance of ... Niskanen 11914
  - electrical properties of ... Tikhonov 12414
  - forces in ... Schmidt 11771
  - isostatic thickness in U. S ... Tsuboi 12348
  - mechanics of deformation ... Goguel 11978
  - radioactive elements in ... Festa 11966
  - structure of ... Bucher 12221
    - Schmidt 11771
  - structure of, deep layers of ... Tuve 12387
    - from Helgoland explosion observations ... Bartels 12184
      - Reich 12185
      - Schulze 12386
      - Willmore 11734
    - from Soltau explosion observations ... Willmore 11734
- Crust, structure of, in Atlantic Ocean Ewing 11729, 11731
  - Hill 11731
  - in continents ... Gutenberg 11727
  - in ocean basins ... Gutenberg 11728
  - off southern California ... Raitt 11733
  - Turkestan-Europe ... Peronaci 12385
  - temperature in ... Thomson 11973
  - viscosity of ... Niskanen 11915
- Cyprus, resistivity surveys for water resources in ... Paver 12467
- Dam sites, seismic refraction surveys near ... Lorenz 12263
  - Nesbit 12256
- Decca Navigator system ... Powell 11864
- Deflection of the vertical, average errors in ... Boaga 12128
  - tables for ... Darling 11680
- Deformation, following Nankaidō earthquake ... Nagata 11959
  - following Tōkaidō earthquake ... Imamura 11958
  - in geosynclines ... Vening Meinesz 12224
- Denmark, gravity measurements in Norges Geog. Oppmålings 12350
  - seismic studies of explosions off coast of ... Lehmann 12183
- Density, determinations by gravity measurements ... Hammer 12447
  - Schleusener 11924
  - internal distribution, effect on gravity variations ... Melchior 12346
  - in interior of the earth ... Bullen 11982
    - Lozano Calvo 11990
  - of Taiwan formations ... Tsung 11925
- Dielectric constant, variation due to heating ... Takubo 11746
- Drill-hole pressure gage ... Biedendieck 12474
- Duplication method ... Frank 11867
- Earth, age of the ... Morelli 11762
  - age of, argon 40 and ... Jeffreys 12209
    - Tatel 12419
    - lead isotopes and ... Holmes 12212
    - recent data on ... Ippolito 12420
- Earth currents, correlation of with magnetic variations ... Tikhonov 12414
  - effect of electric railways on ... Dupouy 12162
  - factors involved in measurement Schmitz 12204
  - observations at Tucson 1932–42 ... Rooney 11745
  - relation to magnetic field ... Rikitake 12412
  - tectonic meaning of variations ... Poldini 12205
  - variations at Dusheti observatory Kebuladze 12203
- Earth model based on compressibility-pressure hypothesis ... Bullen 11982
- Earthquake aftershocks, Ashkhabad, Turkestan ... Masarskii 12395
- Earthquake causes ... Inglada Ors 11942
  - Leiviskä 12436
- Earthquake damage, in relation to structure, Yokohama ... Omote 12401
  - in Yokohama following Kwanto shock ... Omote 12400
- Earthquake depths, method of determining ... Agamennone 11717

	Author	Abstract
Earthquake effects, acoustic	Wanner	11742
hydrodynamic	Werner	12199
on water levels in wells	Parker	12198
visible wave motion	Sato	12399
Earthquake intensity, observations at Gobō and Kiribe, Japan	Sakuma	12405
observations at Kōti, Japan	Minakami	12404
observations in Kwanto and Chūbu-Chihō, Japan	Minakami	12403
relation to epicentral distance	Sato	12402
Earthquake magnitude, determination at Rome	Di Filippo	12189
Earthquake noise	Wanner	11742
Earthquake-resistant construction	Bachinskii	11743
	Medvedev	11744
	Valderrama Suarez	12406
Earthquake sequences, strain characteristics	Benioff	11735
Earthquakes and volcanoes	Rothé	12165
Earthquakes, Anatolia	Pamir	11960
Azores, Nov. 25, 1941	Di Filippo	11719, 11955
Balkan Peninsula	Mihailovič	12191
Greece	Galanopulos	12393
Italy, 1947	Agamennone	11956
Alpi Carniche, May 4, 1934	Agamennone	11957
Tuscany-Romagna, Feb. 11, 1939	Inglada Ors	11720
Japan, Fukui	Nasu	12397
Nankaidō, Dec. 21, 1946	Nagata	11725, 11959
Tokaidō, Dec. 7, 1944	Imamura	11958
Mississippi Valley	Krinitzsky	12390
June 30, 1947	Heinrich	11961
New Zealand, 1947	Hayes	11721
North America	Gutenberg	12190
Philippine Islands, Dec. 29, 1949	Ylanan	12197
South-West Africa	Korn	12396
Spain, 1908-47	Tercedor	12391
Spain, 1947	Gimeno Rintort	12196
Catalonia, 1945	Fontseré	12194
Catalonia, 1946-47	Fontseré	12195
Switzerland, Valais, Jan. 25, 1946	Montandon	11724
	Oulianoff	12398
United States, 1947	Murphy	12389
U. S. S. R	Gorshkov	12394
Yugoslavia, Banat region	Nedeljkovic	12192
Jastrebac region	Milosavlevic	12392
Srem region	Uzelac	12193
Earth tides, in incompressible earth	Takeuchi	12343
Earth waves	Leet	11704
Egypt, gravity measurements in	Cole	11908
Elastic constants, laboratory measurements by pulse methods	Hughes	12231
variation with pressure and temperature	Hughes	12231, 12232
Elasticity, theory of, in general coordinates	Green	12166
Elastic waves, cylindrical, propagation of	Dix	12169
from line source	Lapwood	11709
plane, propagation of through homogeneous strata	Tartakovskii	12022
propagation of, through parallel isotropic layers	Riznichenko	11710
transmission through stratified solid medium	Thomason	12171
in plastics, variation of velocity	Hughes	12232
Electrical exploration methods, airborne	Lundberg	12471
principles	Fritsch	12267
in industry	Jemma	12042
rotation electrodes placed crosswise	Muller	12274
surface and drill-hole	Paul	12268
Electrical exploration using varying frequency	Buchheim	12272
Electrical field, building up of, in ground	Enenstein	12270
ellipsoids of revolution	Semenov	12046
linear conductor	Semenov	12046
point source	Niem	12045
point source in stratified medium	Tikhonov	12047
point source near buried conductive sphere	Lipskaia	11833
rectangular plate parallel to surface	Semenov	12046
screening effect of conductive layers	Mukhina	12460
sphere	Semenov	12046
transient of in unhomogeneous stratified semi-space	Tikhonov	12271
Electrical logging, and radioactivity logging in limestone completions	Bush	11851
Burma oil fields	Tainsh	12069
compared with radioactivity in limestone areas	Mercier	11846
for correlation in northwestern Germany	Tobien	12475
in ground water exploration	Maher	12275
new techniques in California	Stick	11844
relation of resistivity to initial oil production	Spradlin	12070
resistivity, relation to oil production	Milne	12071
correlated with porosity	Calhoun	11835
methods and uses	Doll	11843
self-potential, analysis and interpretation	Doll	12284
connate-water resistivity determinations	Wyllie	11845
stratigraphic interpretation of	Schad	12476
Electrical methods in applied geophysics	Fritsch	12267
Electrical potential, distribution in two-layered medium	Gilchrist	11832
profile surveys, France	Goguel	12059, 12277
potential-drop-ratio surveys	Metzger	11837
Electrical profiling, method	Crumrine	12273

Author Abstract
Electrical resistivity, in two-layered medium.............. Gilchrist 12269
  of reservoir rocks.............. Archie 11991
  relation of, to initial oil production.............. Spradlin 12070
Electrical resistivity curves, as index of geologic conditions...... Kurata 12054
  for buried semi-circular disc..... Kiyono 12053
  for layered structure.......... Makino 12052
Electrical resistivity methods, theory of.................... Huber 12459
  compared with seismic.. U. S. Waterways Experiment Station 12041
Electrical resistivity sounding, effect of discontinuities on....... Schenk 12050
  significance of discontinuties in diagrams.............. Schenk 12049
Electrical resistivity surveying, mean 3-electrode method........ Sato 12055
Electrical resistivity surveys, Bresse and Bas-Dauphiné, France Goguel 12059, 12277
  Cerro de Pasco, Peru........... Kruger 11836
  Fond du Lac, Wisconsin......... Spicer 12058
  for water supplies.............. Cooper 12468
  Paver 12467
  Walters 12469
  Laochunmiao oil field, China.... Chang 12057
  lower Mississippi Valley......... Perret 11838
  Marinha Grande province, Portugal.............. Barbosa Braga 11802
  Quaternary deposits, Finland.. Metzger 11837
  Twin Buttes, Ariz., copper mine Cummings 12470
  West Yorkshire, England, coal seams.............. Whetton 12465
Electrical self-potential, anomalies caused by spheroidal bodies.............. Yüngül 12048
  generating mechanism of.. Nakabayashi 12056
  of reservoir rocks.............. Archie 11991
Electrical self-potential surveys, Cerro de Pasco, Peru......... Kruger 11836
  importance of analysis of variations.............. Petrucci 11834
  Twin Buttes, Ariz., copper mine.. Cummings 12470
Electrode configuration, mean 3........ Sato 12055
  Wenner, analysis of.............. Kiyono 12051
Electrode patterns.............. Crumrine 12273
Electrodes for use in sea water..... Mironov 11965
Electromagnetic exploration, airborne. Lundberg 11810
  indicatrix curve in.............. Fiano 11830
  instruments.............. Belluigi 12463
  radiowave methods.............. Fritsch 11839
  theory of.............. Kiyono 12043
Electromagnetic field, from harmonically varying magnetic.. Belluigi 11831
  pole from point-current source.. Kiyono 12043
  from point source.............. Niem 12045
  in conductive slab.............. Belluigi 12462
Electromagnetic induction, in conductive sphere........... Cagniard 12152
  in rotating sphere.............. Bullard 12151
Electromagnetic measurements in mines, theoretical considerations Belluigi 12464
Electromagnetic processes in electrical prospecting circuits... Enenstein 12044
Electromagnetic waves, plane, reflection from stratified media Brekhovskikh 12167
  propagation in stratified media... Abelès 12461
  spherical, reflection and refraction Brekhovskikh 12168
  velocity of.................. Aslakson 11858
Electrotelluric surveys, France Bur. Recherches géol. et géophys. 12276
Elevation surveying, by barometric means.............. Stripling 11863
Engineering applications of geophysics Hvorosiev 12239
  Lorenz 12263
  Nesbit 12256
  Trefethen 11789
England, resistivity surveys for water Walters 12469
  resistivity surveys of West Yorkshire.............. Whetton 12465
Ethiopia, regional gravity survey.... Pacella 11933
Exploders for simultaneous shot firing Allsop 12479
Exploration, Arctic Alaska....... Greenman 11793
  Canada.............. Beck 11999
  Brown 11784
  Joubin 11795
  Australia.............. Sullivan 11797
  economic and scientific value of Mintrop 11788
  for minerals.............. Dixey 11794
  Kelly 11995
  for petroleum.............. Eby 11786
  Yale 11790
  for water resources.............. Kelly 11998
  geophysical activity in 1948.... Eckhardt 11787
  geophysical activity in 1949... Eckhardt 12236
  Great Britain.............. Browne 11784
  meteorological and oceanographic aspects.............. Glenn 12007
  Paraguay.............. Cox 11791
  recent advances in........... Bruckshaw 11785
  South Africa.............. Nel 11796
  worldwide progress in............ Bailey 11783
Explosions, compared with earthquakes.............. Lehmann 12183
  seismic studies of.............. Bartels 12184
  Lehmann 12183
  Morelli 11732
  Reich 12185
  Schulze 12386
  Willmore 11734
  seismic-wave generation in....... Morris 12026
  seismic waves from.............. Howell 11822
Explosion waves, dispersion of waterborne.............. Dobrin 12388
  propagation of in liquid........... Press 12170
Fault origin of ocean deeps.......... Benioff 11735

	Author	Abstract
Faults, accompanying Fukui earthquake	Nasu	12397
interpretation of, from seismic data	Quarles	12262
Fennoscandia, crustal warping in	Niskanin	11914
glacial and post-glacial earthquakes	Leiviskä	12436
Figure of earth, effect of asymmetry of	Escher	11770
from gravity measurements	Júdice	12342
Finland, electrical surveys of Quaternary deposits	Metzger	11837
Florida, fluctuations of water level in wells	Parker	12198
Fluorologging	Campbell	12074
Formosa. *See* Taiwan.		
Fracture of materials, theory	Seigel	12233
France, electrical surveys, Bresse and Bas-Dauphiné	Bur. Recherches géol. géophys	12276
	Goguel	12059, 12277
gravity surveys, Bresse and Bas-Dauphiné	Bur. Recherches géol. géophys	12276
	Goguel	12059, 12277
Brittany	Bollo	12147
gravity value at Paris	Coron	11928
magnetic anomalies of Auvergne peperino	Roche	12163
radioactivity survey of Aquitaine Basin	Tiratsoo	12215
Galvanometers, with photoelectric feedback	Selenyi	12290
Geiger-Müller counter, all-metal	Lesage	12066
determination of radioactivity of rocks by	Szalay	12213
determination of U-content by	Thommeret	11757
for analysis of potassium deposits	Lutz	12064
for drill holes	Roberts	12285
	Western Miner	11840
for prospecting	Bateman	12279
	Rohrer	12208
	Stead	12061
	Western Miner	11840
gamma-ray counting efficiency of	Jurney	11752
gamma-ray sensitivity of	Hine	11750
high-efficiency	Graf	12416
increasing efficiency of	Slätis	11967
nature, description, and use	Curtiss	11749
	Korff	12206
reconnaissance with in upper Michigan	Kemp	12062
vibrator-type, power supply for	Ives	11969
Geodesy in Egypt	Cole	11908
Geodetic measurements by radar	Halliday	11859
Geoid, regional rise of, in Central Europe	Tanni	11917
Geoid and geophysics	Morelli	12126
Geoid, determination from gravity data	Tanni	11916
Geolograph	Nichols	11857
Geology and geophysics, studies in	Ferraz de Carvalho	12368
Geology for engineers	Trefethen	11789
Geophysical data, diurnal variations in	Tschu	11699
Geophysical directory		12237
Geophysical education, U. S. and Canada, 1948	Macelwane	12002
Geothermal gradient, Colorado Front Range	Birch	12217
Innviertel, Austria	Nathan	12219
Germany, electrical logging	Tobien	12475
exploration of Etzel salt domes	Breyer	12240
geophysical map of northwestern	Reich	11780
geotectonic map of northwestern	Geol. Landesamt	11779
gravity surveys, Alpine foreland	Reich	11777
northwestern salt domes	Closs	12245
regional	Schleusener	12140
western Peribaltic	Zwerger	11778
magnetic surveys, Alpine foreland	Reich	11777
western Peribaltic	Zwerger	11778
seismic surveys, Alpine foreland	Reich	11777
Cuxhaven sand banks	Müller-Deile	12265
northwestern part	Haarstick	12452
	Krey	12457
tectonics, of Hohenzollernalb	Lemcke	11722
northwestern part	Geol. Landesamt	11779
Glaciers, seismic studies of, Alaska	Poulter	12035
seismic studies of, Greenland	Martin	12179
Gradient, geophysical definition	Kunz	11992
Granite, autoradiographic studies of	Hée	12422
Gravimeter, bifilar, optimum dimensions of	Voit	12347
capillary	Ising	11682
	Lagerquist	11910
dynamic	Gilbert	11681
effect of temperature	Grushinskii	12139
electrostatic	Ising	11682
for use in drill holes	Gilbert	11681
for use in submarines	Gilbert	11681
Mott-Smith	Garcia Rojas	12306
Nørgaard	Jelstrup	11683
Worden, as geodetic instrument	Woollard	11920
Gravity, absolute measurement of	Jeffreys	11918
effect of elliptic lamina on	Sergeev	12340
effect of irregularly shaped masses on	Sellien	12448
effect of two-dimensional parallelepided on	Osclaczky	11686
higher derivatives of, from torsion balance measurements	Olczak	12445
new method of measuring	Volet	11911
normal, determination of, in geodesy	Júdice	12341
formula for in Spain	Lozano Calvo	12130
variations of	Baars	11909
	Bollo	12141
	Castro	12142
	Eblé	12143
	Melchior	12346

Author Abstract
Gravity anomalies, and geosynclinal deformation.... Vening Meinesz 12224
  China.... Ku 12148
  Iceland.... Bödvarsson 12146
  local and regional, separation of Magnitskii 11923
  Mexico.... Carreño 12145
  northwest Germany.... Closs 12245
  over salt domes.... Closs 12245
  relation of, to tectonics in Ukrainian S. S. R.... Bogdanov 12351
Gravity corrections, elevation.... Egyed 11684
  in mountainous regions.... Evseev 12345
  in structural studies.... Magnitskii 12344
  topographic, Schweydar method of computing.... Hallenbach 11921
Gravity corrections, topographic-isostatic.... Heiskanen 11922
Gravity data, for geoid determination. Tanni 11916
Gravity expeditions, at sea 1923–38 Vening Meinesz 12354
Gravity exploration, in Mexico.... Carreno 11803
  Garcia Rojas 11800, 12006
Gravity exploration methods, brief description.. Garcia Rojas 11800, 12006
  compared with magnetic method.. Innes 12009
  for minerals.... Romberg 11801
Gravity gradient, adjustment of Tarczy-Hornoch 11687
  vertical, formula for.... Hofmann 11685
Gravity measurements, accuracy of Frolov 12137, 12138
  Grushinskii 12139
  accuracy of density determinations from.... Schleusener 11924
  Algeria.... Lagrula 11932
  in boreholes.... Smith 12446
  in Canadian Arctic.... Beer 12349
  in Denmark.. Norges Geog. Oppmålings 12350
  in Egypt.... Cole 11908
  in Ethiopia.... Pacella 11933
  in Great Britain.... Cook 11926
  in Greenland.... Beer 12349
  in Ireland.... Cook 12352
  in Luxembourg.... Gloden 12132
  in Morocco.... Lagrula 11932
  in Norway... Norges Geog. Oppmålings 12350
  in Sahara.... Lagrula 11932
  in Spain.... Sans Huelin 11929
  in Sweden... Norges Geog. Oppmålings 12350
  revision in standards.... Morelli 11688
Gravity survey of the earth, present state and prospects... Kazanskii 12127
Gravity surveying, submarine, recent advances in.... Cooper 11912
Gravity surveys, Belgium.... Jones 11691
  China, Shanghai City.... Chao 11934
  eastern Atlantic, submarine.... Browne 11927
  France, Bresse and Bas-Dauphiné.... Goguel 12059, 12277
    Brittany.... Bollo 12147
  Germany.... Schleusener 12140
    Alpine foreland.... Reich 11777
    western Peribaltic.... Zwerger 11778
  Italy.... Cunietti 11931
Gravity surveys, Mexico, Vera Cruz Oñate Espinosa 12244
  Morocco.... Garcia Siñeriz 11805
  Netherlands.... de Sitter 12246
  New South Wales, Broken Hill.. Rayner 12451
  Philippine Islands.... Lejay 12353
  Portugal, Marinha Grande.. Barbosa Braga 11802
  Spain, Ciudad Real... Cantos Figuerola 12008
    Segovia province.... Sans Huelin 11930
  Taiwan.... Weng 12247
  United States, Appalachian Mountains.... Woollard 11693
    North Carolina coastal plain.. Skeels 12144
    Texas, Jameson reef.... Brown 11804
    Virginia coastal plain.... Skeels 12144
  Wales and the Borders.... Thirlaway 11692
Gravity tie, Bologna-Milano, Italy. Cunietti 12131
Gravity value, at Kiev.... Grushinskii 12136
  at national reference stations.. Hirvonen 11919
  at Paris and Potsdam compared.... Cagniard 11690
  Gloden 12132
  at Paris in Potsdam system.... Coron 11928
  at Potsdam.... Kazanskii 12129
  Morelli 11688, 11689
  at Teddington.... Kazanskii 12129
  at Washington.... Kazanskii 12129
Great Britain, geophysical exploration in.... Browne 11784
  gravity measurements in southern. Cook 11926
  seismological activities in.... Tillotson 11708
Greece, earthquakes in Messenia. Galanopulos 12393
  resistivity surveys for water.... Paver 12467
Greenland, gravity measurements in... Beer 12349
  seismic studies of glaciers in.... Martin 12179
Gulf of Mexico, petroleum exploration in.... McGee 12001
Gypsum, resistivity surveys for.. Manfredini 12466
Hawaii, eruption of Mauna Loa in 1949.... Macdonald 12429
  magnetic variation anomaly at Honolulu.... Howe 12362
Heat, contribution of radioactive decay of potassium to.... Casertano 11972
Heat balance in the earth.... Noetzlin 12437
Heat flow, beneath oceans.... Benfield 12424
  in Colorado Front Range.... Birch 12217
  to surface of earth.... Slack 11766
Heat transfer from core.... Bullard 11986
Helgoland explosion, seismic observations of.... Bartels 12184
  Reich 12185
  Schulze 12386
  Willmore 11734
  thermal energy.... Bartels 12184
Helicopters, use in oil exploration.... Deegan 11866
Hokutolite, alpha activity of.... Kumura 11756
Iceland, gravity anomalies in.... Bödvarsson 12146
Ilmenite, aeromagnetic surveys for.. Bourret 11814
India, history of geophysical exploration.... Ramachandra Rao 12441
  mineral exploration.... Wadia 12242
  petroleum exploration.... Evans 12000
  seismograph stations in.... Agarwala 12371

Author Abstract

- India Geological Survey, report........ West 12443
  - Geophysical section report....... Dessau 11798
  - geophysical investigations 1945–48 Dessau 12442
- Indiana, aeromagnetic maps of counties in............ U. S. G. S. 11816, 12253
- Indian Ocean, thickness of sediments in.................. Pettersson 11781
- Indonesia, volcanological studies in.............. Petroeschevsky 12432
- Internal constitution of the earth.... Elsasser 11988
- Ireland, gravity measurements in...... Cook 12352
- Iron, magnetic exploration for, in Portugal..... de Andrade 12448, 12449
  - magnetic exploration for, in Sicily................ Melchiori 12016
    - in Utah........................ Cook 12015
- Isostatic anomalies, interpretation of............... Lozano Calvo 11679
- Italy, earthquake in Alpi Carniche.............. Agamennone 11957
  - earthquake in Tsucagny-Romagna.............. Inglada Ors 11720
  - earthquakes in 1947........ Agamennone 11956
  - gravity measurements.......... Cunietti 11931
  - gravity tie, Bologna-Milano.... Cunietti 12131
  - magnetic surveys for iron in Sardinia.............. Melchiori 12016
    - in Marche region.............. Giorgi 12366
  - resistivity surveys for gypsum-sulfur in Sicily...... Manfredini 12466
- Japan, earthquake damage in Yokohama.............. Omote 12400, 12401
  - earthquake intensity observations, at Gobo and Kiribe..... Sakuma 12405
    - at Koti.................. Minakami 12404
    - at Kwantō and Chūbu-chihō. Ikegami 12403
  - earthquake of Dec. 21, 1946 at Nankaidō......... Nagata 11725, 11959
  - earthquake of Dec. 7, 1944 at Tōkaidō.............. Imamura 11958
  - magnetic measurements of Pleistocene deposits............ Nagata 12365
  - magnetic surveys, of Miyake-jima volcano................ Rikitake 12364
    - of Usu-dake............ Koshikawa 12367
  - recent activity of Usu-dake.. Minakami 12433
- Jesuit Seismological Association. Macelwane 12370
- Kamchatka, sinking of coast.... Zen'kovich 12230
- Laboratories, Sun Oil Co......... McCaslin 11799
- Labrador, gravity determination at Goose Bay................ Beer 12349
- Lightning discharge, effect of geology on...................... Norinder 12413
- Logging, fluorescence.............. Campbell 12074
  - mud.......................... Carlson 11856
    - Ziloff 12283
- Lorac.................... World Petroleum 11865
- Louisiana, electrical logging for water resources................ Maher 11275
- Luxembourg, gravity measurement in Cagniard 11690
  - Gloden 12132
- Madagascar, magnetic measurements in...................... Poisson 12159
- Magnetic activity, U-measure of.... Bartels 12158
  - Howe 12157
- Magnetic anomalies, Auvergne peperino, France........................ Roche 12163
  - Baltic Sea region.............. Slaucitajs 11700
  - Gergovie eruptive rocks, France.. Roche 11702
  - Locarno, Switzerland........... Weber 12164
  - negative...................... Bourret 11814
    - Roche 11702, 12163
    - Weiss 11819
    - Balsley 11813
  - over veins...................... Cook 12449
  - uniformly magnetized parallelepipeds.................. Ballarin 12011
  - upward continuation of...... Henderson 11807
- Magnetic bays, statistical studies Princep Curto 11940
- Magnetic changes, associated with volcanic eruptions...... Koshikawa 12367
  - Rikitake 12364
- Magnetic declination, Kabul, Afghanistan.................... Stenz 11939
- Magnetic exploration methods, airborne................ Lundberg 11810
  - compared with gravity........... Innes 12009
- Magnetic field of the earth, and aurora borealis............. Sucksdorff 11936
  - diurnal variation anomaly at Honolulu..................... Howe 12362
  - effect of electric railways on.... Dupouy 12162
  - effect of ionized air current on. Truesdell 12356
  - effect of motion in core.......... Bullard 11935
  - history .... Torreson 11703
  - measurements at high altitudes.. Maple 12156
    - Singer 11698
  - measurements in mines......... Runcorn 12155
  - origin..................... Alfven 12153, 12355
    - Benfield 12149
    - Bullard 12150, 12151
    - Cagniard 12152
    - Elsasser 12988
    - Hardtwig 12235
  - relation to earth currents...... Rikitake 12412
  - second vertical derivative of. Henderson 11806
  - secular variation of.......... Wasserfall 12361
  - tests of theories of............. Hales 11697
  - variations, causes of.......... Sucksdorff 11936
    - correlation with earth currents Tikhonov 12414
    - relation to atmospheric circulation.................. Wulf 12154
- Magnetic field of the sun........ Alfvén 12153, 12355
- Magnetic fields, method of demonstrating..................... Blaha 12357
- Magnetic history of the earth...... Torreson 11703
- Magnetic observations, Madagascar. Poisson 12159
- Magnetic observatory, Moscow Akad. Nauk SSSR 11694
- Magnetic polarization of sedimentary rocks................. Torreson 11703
- Magnetic profiles, aeromagnetic and ground, compared........ Wier 12014

Author Abstract
Magnetic surveys, airborne, Bahamas Bemrose 12013
  airborne, Bikini.... Alldredge 11812
    Michigan, Baraga, Houghton, Iron Counties.... Balsley 11813
    northwestern Maine.... Hurley 11815, 12252
    Quebec, Allard Lake district. Bourret 11814
    South Africa, Vredefort dome. Weiss 11819
  criteria for.... Morelli 12360
  China, Szechwan.... Chen 11941
  Germany, Alpine foreland.... Reich 11777
    western Peribaltic.... Zwerger 11778
  Italy, Marche region.... Giorgi 12366
    Sardinia.... Melchiori 12016
  Japan, Usu-dake.... Koshikawa 12367
  Netherlands.... de Sitter 12246
  New South Wales, Broken Hill.. Rayner 12451
  New Zealand, Rotorua.... Modriniak 12250
  Portugal, Alto Alentejo.... de Andrade 12249
    Montemor-o-Novo mines de Andrade 12248
  South Africa, Witwatersrand.... Ermert 12017
  United States, Michigan, Iron County.... Good 11820
    North Carolina coastal plain.. Skeels 12144
    Virginia coastal plain.... Skeels 12144
    Utah, Iron County.... Cook 12015
Magnetic surveying, airborne, techniques in.... Petroleum 11811
  in structural geology studies.. Branham 12010
Magnetic susceptibility, of conglomerates and powdered substances.... Kondorskii 12358
  of Gergovie eruptive rocks.... Roche 11702
  of magnetite group.... Bossolasco 11701
  thermal changes.... Nagata 12363
Magnetism, measurement by induction method.... Konakhovich 11695
Magnetite, susceptibility of.... Bossolasco 11701
  thermo-remanent magnetism of Al'thausen 11937
Magnetization, Gergovie eruptive rocks Roche 11702
  interior demagnetizing factor in. Petrova 11696
  remanent, Pleistocene deposits, Japan.... Nagata 12365
Magnetometer, airborne.... Cassinis 12012
  Oil 11809
  Rumbaugh 11808
  Schonstedt 12251
  Japanese Geog. Survey Inst. Tsubokawa 12359
  LaCour QHM.... Woo 11938
  variometer, for recording rapid variations.... Castet 12161
  Grenet 12160
Maine, aeromagnetic surveys in northwestern.... Hurley 11815, 12252
Malaya, anomalous behavior of compasses in.... Ingham 12450
Malta, resistivity surveys for water resources in.... Paver 12467
Maps, aeromagnetic, Bikini.... Alldredge 11812
  aeromagnetic, Indiana counties U. S. G. S. 11816, 12253
    Minnesota counties.... U. S. G. S. 11817
    Maine.... Hurley 11815
    Missouri quadrangles U. S. G. S. 11818, 12254
  electrical-resistivity, Bas Dauphiné, France.... Goguel 12059
  electrotelluric, Bresse, France Bur. Recherches géol. géophys. 12276
  geophysical, northwestern Germany.... Reich 11780
  geotectonic, northwestern Germany.... Geol. Landesamt 11779
  gravity, Baltic region.... Zwerger 11778
    Belgium.... Jones 11691
    Brazil. Brasil conselho nacional petróleo 12441
    China, Shanghai.... Chao 11934
    France, Bas Dauphiné.... Goguel 12059
      Brittany.... Bollo 12147
    Germany.... Closs 12245
      Geol. Landesamt 11779
    Indonesian archipelago Vening Meinesz 12354
    Italy, southern part.... Cunietti 11931
    Mexico.... Carreño 12145
      north of Veracruz Oñate Espinosa 12244
    North Carolina coastal plain. Skeels 12144
    Philippine Islands.... Lejay 12353
    Spain.... Sans Huelin 11929
      Segovia.... Sans Huelin 11930
    Taiwan.... Weng 12247
    Virginia coastal plain.... Skeels 12144
    U. S. S. R., Samarskaya Luka region.... Magnitskii 11923
  magnetic, Baltic region.... Zwerger 11778
    Iron County, Michigan.... Good 11820
    Locarno, Switzerland.... Weber 12164
    Montemor-o-Novo mine, Portugal.... de Andrade 12249
    North Carolina coastal plain. Skeels 12144
    Sardinia.... Melchiori 12016
    Szechwan, China.... Chen 11941
    Virginia coastal plain.... Skeels 12144
  radioactivity, Lake Athabaska region, Canada.... Brownell 12067
  seismic probability, United States Roberts 12369
Marine surveys, use of Lorac system in World Petroleum 11865
Mars, constitution of.... Bullen 11983
Massachusetts, seismic refraction surveys off Woods Hole.... Ewing 12188
Megatectonics and geophysics.... Bucher 12222
Mexico, exploration for oil in.... Cumming 11792
  exploration problems in Rodriguez Aguilar 12243
  Geophysical Institute of. Monges Lopez 12003
  gravity anomalies in.... Carreño 12145
  gravity exploration in.... Carreño 11803
  Garcia Rojas 11800

Author Abstract

- Mexico, gravity surveys in Veracruz Oñate Espinosa 12244
  - radioactivity logging in Cervera del Castillo 12472
  - seismic exploration in Rummerfield 12456
  - volcanic activity of Parícutin Fries 11975, 12431
    - Pough 11975
  - volcanoes of Parícutin region Williams 12430
- Michigan, aeromagnetic surveys of Baraga, Houghton, Iron Counties Balsley 11813
  - magnetic survey of Iron County Good 11820
  - Geiger counter reconnaissance in Upper Peninsula Kemp 12062
- Microseisms, associated with cold fronts Lynch 12202
  - correlation with meteorological data Ylinen 11964
  - correlation with solar activity 01' 11962
  - origin Coulomb 12200
    - Giorgi 12410
    - Hardtwig 12201
    - Leet 11739
    - Morelli 11740
    - Zanon 11741
  - periodicity Bath 11737
  - physical nature of d'Henry 12409
  - recorded at Nantes Bernard 12407
  - Rome-Trieste records compared Morelli 12411
  - studies of, in Tokyo Kishinouye 11963
  - tripartite measurements of Leet 11738
- Microseisms, types of Caloi 12408
  - Coulomb 12200
  - Hardtwig 12201
  - Leet 11739
- Mineral resources, depletion of Raggatt 11997
- Minerals and minerals deposits Jones 12238
- Mining geophysics, need for new policies and tools in Geoffroy 11994
  - trends and progress in Lundberg 11996
- Mining problems, use of geophysics in Kelly 11995
- Minnesota, aeromagnetic maps of counties in U. S. G. S. 11817
- Mississippi Valley, earthquakes in Heinrich 11961
  - Krinitzsky 12390
  - electrical resistivity surveys in Perret 11838
  - seismic and resistivity methods compared in U. S. Waterways Experiment Station 12041
- Missouri, aeromagnetic maps of quadrangles in U. S. G. S. 11818, 12254
  - radioactive measurements, Bourbon well core Damon 11971
  - seismic wave velocity near St. Louis Kisslinger 11949
- Morocco, gravity measurements in Lagrula 11932
  - gravity surveys near Larache Garcia Siñeriz 11805
- Mountain making and basalt Bödvarsson 12146
- Mountains, origin of Roubault 11772
- Mud logging Carlson 11856
  - Ziloff 12283
- Neptunium series, possible existence in nature Poole 11753
- Netherlands, gravity and magnetic surveys in southeastern de Sitter 12246
- Nevada, heat and water sources of Steamboat Spring White 12218
- New Guinea, tectonic position of Glaessner 11979
- New Jersey, seismic surveys off Cape May Ewing 12188
- New Mexico, gravity survey of Houston-Thomas prospect Romberg 11801
- New South Wales, gravity and magnetic surveys at Broken Hill Rayner 12451
- New York, seismic surveys off New York City Ewing 12188
- New Zealand, earthquakes in 1947 Hayes 11721
  - electrical and magnetic surveys at Rotorua Modriniak 12250
- Nitrogen, isotopic ratio in radioactive minerals White 12211
- North Carolina, geophysical data on coastal plain Skeels 12144
- Norway, gravity measurement in Norges Geog. Oppmålings 12350
- Nyasaland, resistivity surveys for water resources Cooper 12468
- Ocean deeps, seismic evidence for origin Benioff 11735
- Oceans, greatest depths in Hess 11980
  - heat flow below Benfield 12424
  - properties of crust beneath Gutenberg 11728
- Ohio, gravity surveys in Barberton mine shaft Hammer 12447
- Oklahoma, seismic surveys, Osage county Oliphant 12177
  - seismic surveys, Fort Cobb anticline Campbell 12455
- Ontario, radioactivity measurements, Kirkland Lake area Slack 11766
  - thermal measurements, Kirkland Lake area Thomson 11973
- Orogeny, effect of formation of earth by cold process on Andree 12434
  - frequency and periodicity of Rutten 11733
- Ozark Plateau, seismic-refraction surveys U. S. Waterways Experiment Station 12040
- Pacific Ocean, bottom structure off Southern California Raitt 11733
  - geothermal gradients in Pettersson 11781
  - thickness of sediments in Pettersson 11781
- Paraguay, exploration conditions in Cox 11791
- Parallel plate counter with linear amplifier Kimura 11751
- Parícutin, activity of, early Pough 11976
  - activity of, 1948-49 Fries 11975
    - July-December 1949 Fries 12431
- Parícutin region, volcanoes of Williams 12430
- Pelean structures Bruet 12220
- Pendulums, dynamic temperature coefficient of Frolov 12138
  - effect of vertical temperature gradients on Frolov 12137
  - Lenox-Conyngham Cook 12352

Author Abstract

- Peperino, magnetic anomalies related to ... Roche 12163
- Permeability, diagram for computation ... Andree 12287
  - reservoir rocks ... Archie 11991
- Peru, electrical survey at Cerro de Pasco ... Kruger 11836
  - Huancayo Geophysical Observatory ... Peru. Soc. Ing. 12004
- Petroleum, exploration in Brazil
  Brasil Conselho nacional petroleo 12441
  - exploration in Gulf of Mexico ... McGee 12001
  - exploration methods ... Fabiani 12439
    Cumming 11792
  - exploration organization for ... Toborda 12440
- Petrophysics of reservoir rocks ... Archie 11991
- Philippine Islands, earthquake of Dec. 29, 1949, in Luzon ... Ylanan 12197
  - gravity survey of ... Lejay 12353
- Photogeology ... Guerra Peña 12076
  Mott 11860
- Physical properties of rocks, determination and use ... Hallenbach 12444
  - *See also* specific properties, as, Magnetic, Electric, Elastic.
- Physical properties of reservoir rocks. Archie 11991
- Plastics, elastic constants and wave velocity in ... Hughes 12232
- Poland, Warsaw Geophysical Institute
  Jaroszewicz-Halicka 12005
- Poles, secular displacements of ... Goguel 12435
- Porosity, correlation with resistivity factor ... Calhoun 11835
  - determination from radioactivity logs ... Bush 12286
  - spatial variation of ... Schumann 12288
  - of reservoir rocks ... Archie 11991
- Portugal, gravity surveys, in Marinha Grande ... Barbosa Braga 11802
  - magnetic surveys, in Alto Alentejo
    de Andrade 12249
    - in Montemor-o-Novo iron mines ... de Andrade 12248
  - resistivity surveys, in Marinha Grande ... Barbosa Braga 11802
- Potassium, decay constant of ... Festa 12418
  Jeffreys 12209
  - heat from radioactive disintegration of ... Casertano 11972
- Potassium deposits, analysis by Geiger-Müller counter ... Lutz 12064, 12065
- Poulter method of surface shooting ...
  Petroleo Interamericano 11824
  Poulter 12034, 12035
  Texas Oil Journal 11825
  World Petroleum 11826
- Proportional counters ... Korff 12207
- Quebec, aeromagnetic survey, Allard Lake district ... Bourret 11814
  - gravity and magnetic surveys, Val d'Or ... Innes 12009
- Radar for geodetic measurements .. Halliday 11859
- Radioactive methods in geophysical prospecting ... Aliverti 11841
- Radioactive minerals, equipment for prospecting ... Stead 12281
  - exploration methods for ... Almeida Rolff 12063
    Hatsuda 12060
    Marcuse 11842
    Stead 12061
    Western Miner 11840
  - isotopic ratio of nitrogen in ... White 12211
- Radioactive series, possible existence of neptunium ... Poole 11753
- Radioactivity, detection and measurement of ... Curtiss 11747
  - distribution in earth ... Festa 11966
  - granite ... Hurley 11765
  - in geology ... Curtiss 11747
  - Ontario batholiths ... Slack 11766
  - physical nature of ... Curtiss 11747
  - potassium ... Festa 12418
    Jeffreys 12209
  - reservoir rocks ... Archie 11991
  - rhyolite porphyry, Bourbon, Mo. Damon 11971
  - samarium ... Picciotto 11754
  - sediments ... Tiratsoo 12214
  - ultramafic rocks ... Davis 11764
  - *See also* under Autoradiographic techniques, Geiger-Müller counters, parallel plate counters, scintillation counters and special topics.
- Radioactivity logging, and electrical, in limestone areas ... Bush 11851
  Mercier 11846
  - compared with electrical logs ... Thomeer 12473
  - dry gas sand, location by ... Campbell 11852
  - Geiger-Müller counter for ... Roberts 12285
  - improved methods in California. Norelius 11854
  - in Colorado-Wyoming area ... Ray 12072
  - in northeastern Mexico
    Cervera del Castillo 12472
  - in Texas ... Bush 11850
    Woodward 11855
  - laboratory studies ... Tittle 11849
  - neutron ... Faul 11848
  - porosity determination from ... Doll 12286
  - recording forms for ... Mercier 11853
  - theory and practice of ... Tiratsoo 11847
  - use of, in western Canada ... McGaha 12073
- Radioactivity surveys, airborne ... Stead 12282
  - Aquitaine Basin, France ... Tiratsoo 12215
  - Lake Athabaska, Canada ... Brownell 12067
- Radio surveying techniques ... Powell 11864
  World Petroleum 11865
- Radiowave exploration methods ... Fritsch 11839
- Reefs, geophysical exploration for ... Agnich 11829
  - gravity surveys for ... Brown 11804
- Reservoir rocks, petrophysics of ... Archie 11991
- Resistivity, relation to initial oil production ... Spradlin 12070
- Resistivity factor, correlation with porosity ... Calhoun 11835
- Rhyolite porphyry, radioactivity of at Bourbon, Mo ... Damon 11971
- Rigidity in the earth's mantle ... Nishimura 11913
- Rotation of earth during evolution. Jardetzky 11768

Author Abstract

- Rumania, seismic surveys near Bicaz dam .... Lorenz 12263
- Sahara, gravity measurements in ..... Lagrula 11932
- Salt domes, geophysical exploration of .... Breyer 12240
- Closs 12245
- Krey 12457
- Samarium, half life of .... Picciotto 11754
- Saskatchewan, radioactivity measurements near Lake Athabaska .... Brownell 12067
- Scintillation counters, application of. Johansson 12417
  - for alpha measurements .... Goldin 12280
  - Holland 11755
  - gamma-ray sensitivity of .... Aler 12415
  - Hine 11750
  - liquid .... Reynolds 11968
  - new techniques in design .... Ageno 11970
  - portable .... Brownell 12067
  - Goldin 12280
  - Pringle 12278
- Sedimentary rocks, magnetic properties of .... Torreson 11703
  - seismic velocities in .... Oliphant 12177
- Seismic computing methods, for steep-dip areas .... Rice 12038
- Seismic exploration, basic principles.. Heroy 12018
  - composite-reflections method ..... Ricker 12033
  - computation charts for linear velocity increase .... Agocs 12037
  - development of .... Gilmour 12255
  - dynamic methods of .... Hertwig 12458
  - Lorenz 12257
  - effect of on wells .... Schoff 12021
  - efficiency of size of charges in ..... Shock 12028
  - hazards .... Anderson 12020
  - in Mexico, problems .... Rummerfield 12456
  - marine, development of .... Guseman 11827
  - marine, off California coast Petroleum World 11828
  - of limestone reefs .... Agnich 11829
  - Poulter method. Petroleo Interamericano 11824
  - Poulter 12034, 12035
  - Texas Oil Journal 11825
  - World Petroleum 11826
  - progressive detonation of multiple charges .... Shock 12028
  - refraction, graphical method of interpretation .... Slotnick 12036
  - relation of research to field operations .... Green 12019
  - shot-instant transmission in ..... Hattori 12024
  - state of .... Gilmour 12255
  - surface shooting Petroleo Interamericano 11824
  - Poulter 12034, 12035
  - Texas Oil Journal 11825
  - World Petroleum 11826
  - velocity indicator curves in ..... Berson 11821
- Seismic exploration instruments, shaking table for .... Bardeen 12291
- Seismic exploration records, diffracted waves on .... Epinat'eva 12030
  - effect of electrical transmission on .... Buchheim 12259

Author Abstract

- Seismic quasi-anisotropy .... Riznichenko 11710
- Seismic reflections, composite .... Ricker 12033
  - depth and slope determination from .... Krouskij 12032
  - Langhammer 12453
  - effect of refraction phenomena ..... Krey 12261
  - energy variations in .... Savitt 12027
  - frequency of .... Clewell 12025
  - oblique, analysis of .... Hazebroek 12039
  - path-time curves for .... Haarstick 12452
  - recognition and evaluation of ..... Krey 12031
  - steep-dip computing methods for ... Rice 12038
- Seismic refraction methods, compared with electrical .... U. S. Waterways Experiment Station 12041
  - graphical method of interpretation .... Slotnick 12036
- Seismic surface waves, dispersion in Atlantic basin .... Caloi 12384
  - group-velocity of .... Valle 12174
  - Love, effect of internal friction on. Valle 12173
    - effect of low-velocity layer on .... Stoneley 11944
    - intensity at the surface .... Valle 12374
    - velocity in Atlantic Ocean ..... Caloi 11954
  - nature of .... Menis 12181
  - periods of from distant earthquakes .... Giorgi 12180
  - Rayleigh, propagation in dispersive elastic media .... Sezawa 12172
    - true and pseudo .... Scholte 11946
    - velocity in Atlantic Ocean ..... Caloi 11954
    - velocity of in Azores earthquake .... Di Filippo 11955
- Seismic surveys, Atlantic Ocean ..... Ewing 12187, 11730
  - Bikini .... Dobrin 12388
  - Germany, Alpine foreland .... Reich 11777
    - Cuxhaven sandbanks. Müller-Deille 12265
    - northwest .... Krey 12457
  - interpretation of faults in .... Quarles 12262
  - limestone areas. U. S. Waterways Experiment Station 12040
  - Rumania, Bicaz dam site .... Lorenz 12263
  - Spain, Miajadas .... Cantos Figuerola 12264
  - United States, Atlantic Coastal Plain .... Ewing 12188
    - North Carolina coastal plain. Skeels 12144
    - off Cape May, N. J .... Ewing 12188
    - off New York City .... Ewing 12188
    - off Woods Hole, Mass .... Ewing 12188
    - Oklahoma, Fort Cobb anticline .... Campbell 12455
    - Ozark Plateau dam sites U. S. Waterways Experiment Station 12040
    - Virginia coastal plain .... Skeels 12144
  - use in civil engineering .... Nesbit 12256
- Seismic waves, azimuthal control of amplitudes of P and PP. Byerly 11716
  - form of, from line source .... Lapwood 11709
  - from explosions .... Howell 11822
  - in Caribbean Sea bottom ..... Coulomb 12178

Author Abstract
Seismic waves, longitudinal, dispersion of .... Altenburg 11945
  velocity in Paleozoic rocks. Kisslinger 11949
  M_2, existence on records .... Kanai 12383
  mechanism of generation by explosives .... Morris 12026
  Mintrop, travel time curves for. Berson 12260
  reflected at core, observed amplitudes .... Martner 11950
  S and SKS travel time curves .... Valle 11723
  travel times at Uppsala .... Bath 11718
  velocity, at short distances .... Aliverti 12182
    from Helgoland explosion .... Reich 12185
    in field and laboratory compared .... Oliphant 12177
    in Greenland glaciers .... Martin 12179
    in laboratory .... Röthlisberger 12381
    in sandstones .... Röthlisberger 12381
    in sedimentary rocks .... Oliphant 12177
    in Taku glacier, Alaska .... Poulter 12035
    off California shore .... Raitt 11733
    related to change in pressure .... Iida 12029
    related to depth and lithology .... West 12382
    related to self-potential log data .... Handley 11823
Seismic well shooting, and linear increase of velocity .... Slotnick 12454
Seismograms, determination of true ground motion from .... McComb 11715
  interpretation between 80° and 120° .... Valle 11723
Seismograph, arc-light timing marker for .... Volk 12380
  calibration .... Honnell 12289
  Cartuja observatory .... Due Rojo 11947
  crystal accelerometer .... Gassmann 12375
  electrical, for field use .... Trappe 12023
  electromagnetic, determination of constants .... Rouaud 11714
  ink-recorder for .... Sulkowski 12376
  inverted pendulum horizontal. Takahashi 11713
  magnification of galvanometric. Ingram 11948
  nomogram for magnification .... Ikegami 12379
  photoelectric .... Volk 12377
  response to arbitrary motion .... Sezawa 12176
  spring-suspension, secondary resonance of .... Antsyferov 12175
  strong motion .... Nasu 12378
Seismograph testing, application of feedback to transducer for .... Honnell 12289
Seismological activities in Great Britain .... Tillotson 11709
  U. S. Coast and Geodetic Survey 1948 .... Roberts 12369
Seismological station, Fresno, California .... McKim 11706
  Galerazamba, Colombia. Ramirez 11707, 11943
  India Meteorological Department .... Agarwala 12371
Seismology, bibliography of .... Milne 11705
  lectures on .... Broggi 12372
Seismology and seismometry, textbook .... Savarenskii 12373
Seismology and volcanism, textbook. Rothé 12165

Author Abstract
Shaking table .... Bardeen 12291
Soil mechanics, use of seismic methods in .... Hertwig 12458
Soil sampling, geophysical exploration and .... Hvoroslev 12239
Solar system, age of .... Morelli 11762
South Africa, aeromagnetic survey, Vredefort dome .... Weiss 11819
  magnetic exploration of Witwatersrand .... Ermert 12017
  modern methods of exploration in. Nel 11796
South West Africa, earthquakes in .... Korn 12396
Spain, earthquakes in Catalonia. Fontseré 12194, 12195
  earthquakes in 1947 .... Gimeno Riutort 12196
  exploration for water resources in .... Cantos Figuerola 12008
  gravity formula for .... Lozano Calvo 12130
  gravity measurements in .... Sans Huelin 11929, 11930
  seismicity of Granada lowland. Tercedor 12391
Steam blast eruptions .... Jaggar 12426
Structural geology, magnetic surveys in studies of .... Branham 12010
Structure, crustal, beneath oceans. Gutenberg 11728
  crustal, in continents .... Gutenberg 11727
  of the earth .... Bullen 11982
    Bethune 12234
    Hertwig 12235
    Inglada Ors 11942
    Bonchokovskii 12438
Submarine canyons, origin of .... Emery 12229
Sulfide ores, gravity exploration for .... Innes 12009
Sulfur, resistivity surveys for, in Italy .... Manfredini 12466
Surface history of the earth .... Wasiutynski 11769
Sweden, gravity measurements in .... Norges Geog. Oppmålings 12350
Swedish deep-sea expedition 1947–48 .... Pettersson 11781, 12186
Switzerland, earthquakes in Valais .... Mantandon 11724
    Oulianoff 12398
  magnetic anomalies near Locarno. Weber 12164
Taiwan, density of geologic formations in .... Tsung 11925
  gravity surveys in .... Weng 12247
Taku glacier, seismic velocities in .... Poulter 12035
Tectonic forces, from thermodynamic processes .... Matschinski 12223
Tectonics, effect on earth currents .... Poldini 12205
  geophysical methods in interpretation .... Oulianoff 11774
  of southeastern United States .... King 12226
Tectonics and geophysics .... Bucher 12222
Temperature distribution in the earth .... Rikitake 12425
Temperature in an accreting earth .... Benfield 11767
Texas, gravity survey in Jameson reef area .... Brown 11804
  radioactivity logging in .... Bush 11850
    Woodward 11855
Thermal conductivity in earth .... Rikitake 12425
Thermal diffusivity of soil .... Kolmogorov 12068

	Author	Abstract
Thermal gradients, in ocean basins	Pettersson	11781
Kirkland Lake, Ontario	Thomson	11973
Yenangyaung, Burma	Tainsh	12069
Thermal springs, sources of heat and water supply	White	12218
Tides in the earth	Nishimura	11913
Time recorder	Müller	12075
Tonga-Kermadec Islands earthquake sequences	Benioff	11735
Torsion balance, Eötvös	Kilchling	12133
equation of	Kilchling	12134
for measuring U_{zzx} and U_{zzy}	Kilchling	12135
T-phase, at Caribbean stations	Coulomb	12178
from shallow focus earthquakes	Tolstoy	11951
use in tsunami-warning systems	Ewing	11952
Trieste, Gulf of, seismic studies of explosions in	Morelli	11732
Tsunami warning systems	Ewing	11952
Turkestan, aftershocks of earthquake in Ashkhabad	Masarskii	12395
Ukrainian S. S. R., gravity anomalies in	Bogdanov	12351
gravity value at Kiev	Grushinskii	12136
U. S. Coast and Geodetic Survey seismological work in 1948	Roberts	12369
U. S. earthquakes in 1947	Murphy	12389
U. S. S. R., earthquakes in	Gorshkov	12394
gravity studies in Caucasus mountains	Evseev	12345
magnetic observatory at Moscow	Akad. Nauk SSSR	11694
volcanism in	Vlodavets	11977
Utah, magnetic exploration in Iron County	Cook	12015
Variometers, electromagnetic, for recording rapid variations	Castet	12161
	Grenet	12160
Veins, magnetic anomalies over	Cook	12449
Vredefort dome, aeromagnetic survey of	Weiss	11819
Vibration meter, portable electronic	Carome	12258
Vibration pickups, calibration	Haskell	11862
Vibration studies, masonry and buildings	Ramspeck	12266
Virginia coastal plain, geophysical data on	Skeels	12144
Viscosity in the earth	Niskanen	11915
Volcanic activity, Parícutin	Fries	11975, 12431
	Pough	11976
Usu-dake	Minakami	12433
Volcanic eruptions, magnetic changes associated with	Koshikawa	12367
	Rikitake	12364
Mauna Loa, 1949	Macdonald	12429
Volcanic rocks, magnetic transition points in	Nagata	12363
Volcanic structures, pelean, on La Soufrière	Bruet	12220
Volcanic tremor, origin of	Omer	12427
Volcanism, effect of assymmetrical shape of earth on	Escher	11770
pelean structures in	Bruet	12220
steam-blast eruptions in	Jaggar	12426
Volcanoes, and earthquakes	Rothé	12165
in Aleutian Islands	Coats	12428
in Indonesia	Petroeschevsky	12432
in U. S. S. R.	Vlodavets	11977
Volcanological observations	Perret	11974
Wales, gravity survey in	Thirlaway	11692
Water level, causes of fluctuations in	Parker	12198
Water resources, electrical exploration for	Cantos Figuerola	12008
	Cooper	12468
	Kelly	11998
	Paver	12467
	Walters	12469
electrical logging for	Maher	12275
gravimetric exploration for	Cantos Figuerola	12008
geophysics in exploration, exploitation, and conservation	Kelly	11998
seismic surveys for	Cantos Figuerola	12264
	Kelly	11998
Wells, effect of seismic shooting on	Schoff	12021
West Indies, La Soufrière on Guadeloupe	Bruet	12220
Wisconsin, resistivity surveys in Fond du Lac County	Spicer	12058
Wyoming, radioactivity logging in	Ray	12072
Yugoslavia, earthquakes in	Milosavlevic	12392
	Nedeljkovic	12192
	Uzelac	12193

PATENT INDEX

	Author	Abstract
Acoustic well-logging apparatus	Kean	12505
Airborne radioactivity surveying	Goldstein	11891
Alpha ray source	Blau	12093
Altimeter	Shockley	12122
Bolometer	Brockman	12303
	Rutherford	12497
Blasting machine	Gibson	12082
	Parr	12484
Coring and fluid sampling device	Rolshausen	12105
Coring method	Walls	12107
Coring tool	Denning	12108
	Lebourg	12109
	Sewell	11901
Detonation meter	de Boisblaine	12510, 12511
Dip and strike determination from cores	Subkow	11905
Distance-measuring system	Wright	12116
Drilling rate logging	Hayward	11899
Echo-ranging system	Kiebert	12121
Electrical exploration method	Lundberg	12298
	Thompson	12490
Electrical logging method	Broding	12507
	Martin	11907
	Silverman	12501
Electrical instrument with heat-actuating indicator	Smulski	12326, 12327
Electromagnetic exploration	Lindblad	12489
Elevation meter	Silverman	12112, 12113, 12508
Explosive charge, safety catch	Deputy	12509
Galvanometer	Doll	12323
	Heiland	12512
	Kellogg	12123
	Morrow	12321, 12322
Geiger-Müller counter	Friedman	11893
	Malter	11895
	Shamos	12310
	Shore	12087
Gravimeter	Shivers	12320
	Sweet	12292
Hydrophone	Merten	11872
Hygrometer	Lutz	12330
Inclinometer	Cockerell	12115
Infra red detector	Offner	12328
Ionization chamber	Fearon	12085
	Kennedy	12495
	Segre	12309
Ionizing particles, method and apparatus for detecting	Graves	12088
Linear integration meter	Herzog	11892
Magnetic exploration system	Lundberg	12298
Magnetic flux measuring apparatus	Plesset	12079
Magnetic logging	Russell	12500
Magnetic properties of well cores, method and apparatus for determining	Herrick	11870
Magnetic testing	Harrison	12482
Magnetometer	Fearon	12295
	Johnson	12481
	Rothkamp	12480
	Rubenstein	11869
	Stein	11868
	Wyckoff	12293
	Zuschlag	12294
Mud logging apparatus	Huber	11906
Mud logging method	Chaney	12502
	Hayward	12503
Neutron detector	Crumrine	12096
	Herzog	11890
Neutron-generating apparatus	Salisbury	11881
Neutron logging equipment	Fearon	12311, 12313
	Thayer	12315
Neutron logging method	Fearon	12312
	Swift	12316
	Thayer	12314
Neutron meter	Stauffer	12091
Pendulum, vertical, stabilized	Null	12078
Perforation apparatus	Muskat	11900
	Tow	12104
Permeameter	Dietert	12329
	Morris	12319
Probe, electronic	Daum	12084
Proportional counter	Blair	11886
	Manley	12493
Radiation comparison device	Vassy	12095
Radiation counter tube	Dudley	11882
Radiation detector	Dodson	12305
	Ghiorso	11883
	Hare	12089
	Herzog	11884, 12097
	Kanne	12300
	Liston	11888
	Molloy	11887
	Morton	12304
	Neil	12301
	Neufeld	12302
	Perlow	12299
	Weisz	12308
	Wilson	12306
Radiation intensity meter	Carlin	12494
	Fahrner	12491
Radiation measurement, apparatus	Rossi	12090
	Wannier	12086
Radiation measurement, method	Golay	11894

	Author	Abstract
Radioactivity exploration method	Callahan	12492
	Herzog	12496
Radioactivity logging	Crumrine	12106
	Hayward	12504
	Herzog	11897, 12101, 12110
	Krasnow	11903
	Pontecorvo	12092
	Siegert	12100
Radioactivity logging apparatus, shield for	Krasnow	12317
	Silverman	11904
Radioactivity logging apparatus, voltage control and stabilizing circuits	Herzog	11898
Radio detection system	Ayres	12119
	Gross	12120
Radiographic scanning unit	Kaiser	12094
Radio position determining system	Hawkins	12331, 12332, 12333, 12334, 12335, 12336, 12337, 12338, 12339.
Saturation, method of determining	Reichertz	12307
Seismic exploration apparatus	Hawkins	12331, 12336
	McKinney	11871
Seismic exploration interpretation	Coan	12488
	McGuckin	12487
Seismic exploration method	Dahm	12080
	Scherbatskoy	12296
Seismic exploration system for dip determination	Wolf	11877
Seismic wave amplifier, method of testing	Hawkins	11874
Seismic wave transmitter	Dohlberg	12297
Seismograph	Henson	12486
Seismograph compositing circuit	Olson	12083

	Author	Abstract
Seismograph gain control system	Loper	12483
	Shimek	11875
Seismograph recorder	Henson	12485
Seismometer coupling	Williams	11880
Sidewall sample taker	Brimble	11902
Temperature responsive measuring apparatus	Smith	12098
	Vogelsang	12099
Time interval measuring device	Newsom	12124
Time interval recorder	Barnes	12324
	Hasbrook	11876
Transducer	Claassen	12117
	Holden	11879
	Williams	11878
Ultrasonic waves, apparatus for examination of materials by	Meunier	12081
Underwater meter-leveling device	Goetsch	12118
Vibrating table	Bender	12114
	Calver	12125
Vibration testing apparatus	Smith	12513
Wave detector	Nicolson	11873
Well logging, fluid ingress	Silverman	12318
Well-logging apparatus	Vincent	12499
Well-logging recorder	Fearon	12111
	Scivally	12506
Well logging while drilling	Arps	12498
Well signalling apparatus	Goble	11896
	Herzog	11897
Well surveying recording apparatus	Scherbatskoy	12102

Geophysical Abstracts 140-143 January-December 1950

(Numbers 11679–12513)

GEOLOGICAL SURVEY BULLETIN 976

Abstracts of world literature
contained in periodicals,
books, and patents

DEPARTMENT OF THE INTERIOR
March 3, 1849

UNITED STATES DEPARTMENT OF THE INTERIOR

Oscar L. Chapman, *Secretary*

GEOLOGICAL SURVEY

W. E. Wrather, *Director*

CONTENTS

[The letters in parentheses are those used to designate the chapters for separate publication]

Page

(A) Geophysical Abstracts 140, January–March 1950 (nos. 11679–11907) 1

(B) Geophysical Abstracts 141, April–June 1950 (nos. 11908–12125) 71

(C) Geophysical Abstracts 142, July–September 1950 (nos. 12126–12339) 141

(D) Geophysical Abstracts 143, October–December 1950 (nos. 12340–12513) 211

Index to Geophysical Abstracts 140–143, 1950 267

Under Departmental orders, Geophysical Abstracts have been published at different times by the Bureau of Mines or the Geological Survey as noted below:

1–86, May 1929–June 1936, Bureau of Mines, Information Circulars. [Mimeographed.]
87, July–December 1936, Geological Survey, Bulletin 887.
88–91, January–December 1937, Geological Survey, Bulletin 895.
92–95, January–December 1938, Geological Survey, Bulletin 909.
96–99, January–December 1939, Geological Survey, Bulletin 915.
100–103, January–December 1940, Geological Survey, Bulletin 925.
104–107, January–December 1941, Geological Survey, Bulletin 932.
108–111, January–December 1942, Geological Survey, Bulletin 939.
112–127, January 1943–December 1946, Bureau of Mines, Information Circulars. [Mimeographed.]
128–131, January–December 1947, Geological Survey, Bulletin 957.
132–135, January–December 1948, Geological Survey, Bulletin 959.
136–139, January–December 1949, Geological Survey, Bulletin 966.
140–143, January–December 1950, Geological Survey, Bulletin 976.

Geophysical Abstracts 140 January-March 1950

numbers (11679–11907)

GEOLOGICAL SURVEY BULLETIN [illegible]

Geophysical Abstracts 140 January-March 1950

(Numbers 11679–11907)

By MARY C. RABBITT, V. L. SKITSKY, *and* S. T. VESSELOWSKY

GEOLOGICAL SURVEY BULLETIN 976-A

Abstracts of world literature
contained in periodicals,
books, and patents

DEPARTMENT OF THE INTERIOR
March 3, 1849

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1950

UNITED STATES DEPARTMENT OF THE INTERIOR

Oscar L. Chapman, *Secretary*

GEOLOGICAL SURVEY

W. E. Wrather, *Director*

For sale by the Superintendent of Documents, U. S. Government Printing Office Washington 25, D. C. Price 25 cents (paper cover). The printing of this publication has been approved by the Director of the Bureau of the Budget, February 1948

CONTENTS

Page
Introduction 1
Earth physics 3
  Gravity 3
  Magnetism 1
  Seismology 11
  Electricity 22
  Radioactivity 23
  Geothermal studies 28
  Tectonophysics 28
  Regional studies 30
Exploration geophysics 33
  General 33
  Gravimetric methods 36
  Magnetic methods 37
  Seismic methods 42
  Electrical methods 44
  Radioactive methods 47
  Well logging 48
  Technical aids 52
Patents 53
  Magnetic methods 53
  Seismic methods 54
  Radioactive methods 58
  Well logging 62
Index 67

GEOPHYSICAL ABSTRACTS 140, JANUARY–MARCH 1950

By Mary C. Rabbitt, V. L. Skitsky, and S. T. Vesselowsky

INTRODUCTION

Geophysical Abstracts are prepared by the Geophysics Branch of the Geological Survey, United States Department of the Interior, as an aid to those engaged in geophysical research and exploration. Periodicals, books, and patents are regularly searched for material dealing with geophysical exploration methods and with basic earth physics as represented by the fields of gravity, magnetism, electricity, seismology, radioactivity, and geothermal studies.

Because of the increasing diversity and amount of material covered, it has been found necessary to rearrange the order of the abstracts. Material in this issue has been grouped in three sections dealing with earth physics, exploration geophysics, and patents. The first section has been further divided into sections for gravity, magnetism, seismology, electricity, radioactivity, geothermal studies, tectonophysics, and regional studies. The section on exploration geophysics covers gravimetric methods, magnetic methods, seismic methods, electric methods, radioactive methods, well logging, and technical aids. Within each group the order of the abstracts is as follows: general papers, bibliographies, and reviews; theory; instruments; methods and techniques; observations.

As many readers may not have ready access to the source material, the abstracts are intended to be informative. All facts and opinions stated are those of the authors cited, except material needed for clarification which may be added in brackets. Where geologic and geographic names quoted differ from the official usage of the United States Geological Survey or the decisions of the United States Board on Geographical Names respectively, the latter are added in brackets.

Geophysical Abstracts 1–86 and 112–127 were issued as Information Circulars by the Bureau of Mines, and 87–111 were issued as Bulletins of the Geological Survey. Beginning with 128, Geophysical Abstracts are published as Bulletins of the Geological Survey.

As long as available, Geophysical Abstracts 124–127 issued as Information Circulars may be obtained free of charge from Publications Distribution Section, Bureau of Mines. All other numbers are now out of print. Geophysical Abstracts issued as Bulletins of the Geological Survey (with the exception of Nos. 87 and 88) may be purchased as single copies or by subscription from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. For subscription, the Superintendent will accept a deposit of $5 in payment for subsequent issues. When this fund is near depletion, the subscriber will be notified. The deposit may also be used to purchase any other publication from the Superintendent of Documents.

Acknowledgments. Special thanks are due to Roland G. Henderson and Isidore Zietz who have prepared the abstracts signed R. G. H. and I. Z. Advice and assistance of other members of the Geological Survey in the preparation of the manuscript is gratefully acknowledged.

EARTH PHYSICS

GRAVITY [1]

11679. Lozano Calvo, Luis. Sobre la interpretación de las anomalías isostáticas [On the interpretation of isostatic anomalies]: Rev. Geofís., vol. 7, no. 26, pp. 156–165, 1948.

Theories of isostasy are reviewed.—*S. T. V.*

11680. Darling, F. W. Fundamental tables for the deflection of the vertical: U. S. Coast and Geodetic Survey Special Pub. 243, 38 pp., 1949.

Fundamental tables of the Cassinis type for the deflection of the vertical are valuable in calculations of incomplete isostatic compensation or overcompensation. They also provide means of testing the consequences of all sorts of variations in subsurface density and of testing the effect of varying definitions of isostasy. The tables give the deflection caused by masses of unit density which are sections of wedges cut by two conical surfaces with a common apex and a common axis passing through the deflection station and bounded above and below by surfaces of spheres concentric with the earth treated as a sphere. In the computation the radius of the earth is taken as 6371.2 kilometers, the gravitational constant as 6.670×10^{-8} c. g. s. units, and the mean gravity of the earth as 982.03 gals.—*S. T. V.*

11681. Gilbert, R. L. G. A dynamic gravimeter of novel design: Physical Soc Proc., vol. 62, no. 7, no. 355B, pp. 445–454, 1949.

The main element of the new dynamic gravimeter is a vertically stressed thin strip of beryllium copper supporting a mass capable of vibrating laterally. Variations of the weight of the mass, caused by changes in gravity force, produce variations in stress of the wire and therefore variations of the natural frequency of the system, this frequency being proportional to the square root of the stress. Changes of the frequency are determined by comparison with a fixed crystal frequency standard. In the instrument built by the author, with the string vibrating at 1,000 cycles per second a reading correct to 1 in 10^6 can be obtained in one hundred seconds. This accuracy can be improved to 1/50 cycle and thus accuracy of 1 in 10^8 can be obtained in about half an hour, making the instrument adaptable to measurements of earth tides. This particular instrument was designed for use at sea, and therefore the weight hanging on the string was damped electromagnetically for lateral and vertical movements and for rotations. An electronic thermostat kept the temperature inside of the casing constant to within $+0.0005°$ C. Details of construction of different parts of the instrument are given, as well as of the recording system employed for comparison of frequencies.

A gravimeter of the new design was used at sea during a cruise of a submarine in the English Channel, with a Vening-Meinesz three pendulum apparatus as a standard of reference. In spite of certain small imperfections the readings of the new gravimeter made at sea were affected with a probable error of only 1.5

---

[1] See also Geophys. Abstracts 11784, 11802, 11803.

mgal., the same as the pendulum determinations. The small dimensions of the instrument—3½×8 inches—make possible its use for measurements in drill holes.—*S. T. V.*

11682. Ising, Gustaf. Attempts to replace the elastic comparison force in gravimeters by capillary and electrostatic forces: K. svenska vetensk. arkiv. mat., astron. fys., Band. 36, Hefte 3, no. 7, 8 pp., 1949.

Following a suggestion in 1937 by the author that the elastic force in static gravimeters be replaced by capillary or electrostatic forces, experiments have demonstrated the possibility of obtaining a high degree of accuracy with such apparatus. In the capillary gravimeter, a capillary tube dips into the hermetically closed vessel containing the fluid and the position of the meniscus is observed through a microscope objective. The major problem in the design was to counteract the influence of variable temperature on capillary force and the sensitivity of the instrument to jerks during transportation. Hydrocarbons of the paraffin type, such as petroleum and benzine, were found to be the most suitable fluids for the purpose because of their extremely constant capillary properties. A description of the experimental capillary gravimeter and the theory of its operation are given. Gravity differences could be determined with a mean error of about 0.5 mgal. when the measurements were made on solid ground, and of 3 mgal. on board ship.

In designing the electrostatic gravimeters, the main difficulty was the necessity to attain an almost perfect insulation of the electroscope. The problem was solved by using a cascade-arrangement. Experiments with such gravimeters, though not yet concluded, appear to be very promising.—*S. T. V.*

11683. Jelstrup, G. Beskrivelse av Nørgaards gravimeter [Description of the Nørgaard gravimeter]: Norges Geog. Oppmålings virksomhet, Beretning, 1948, pp. 38–43, 1949.

The construction and theory of operation of the Nørgaard gravimeter of the newest type are described. Controlling relations are derived and analyzed to attain the greatest possible precision of measurement. Special attention is given to parts which eliminate the influence of the temperature variation by using materials of opposite temperature coefficients and by constructive arrangement. These changes in the original design of the gravimeter insure a temperature correction of only 1–2 milligals for a maximum temperature variation of 10° C. inside the housing. If a special thermostat is in operation the temperature inside the housing can be kept constant to within a fraction of a degree, making the temperature correction of an individual reading as low as 1/100 milligal. The description is illustrated by five drawings of the instrument.—*S. T. V.*

11684. Egyed, László. Az anomáliák magassági redukciójáról [The elevation correction of anomalies] [In Hungarian and English]: Földtani Közlöny, vol. 79, no. 1–4, pp. 94–111, 1949.

The necessity of making reductions for gravity anomalies as well as for the earth's theoretical gravity effects is stressed. Such reductions of g-anomalies can be obtained with the aid of a Taylor's series provided the vertical gradient, G_z, and the "vertical gradient of second order", $\partial G_z/\partial z$, have been determined. The latter may be readily computed from torsion-balance measurements.

A method is given for the determination of the vertical gradient of an anomaly by connecting the torsion-balance and gravity-meter observations in an area of different elevations. For two points of different elevations the following values are supposed known, the Bouguer anomaly determined by the gravity meter, the gradient components determined by the torsion balance, and the third-order derivatives of the potential function determined by the aid of the torsion-balance measurements. A formula is obtained which gives the average value of the vertical gradient as the quotient of the deviation resulting from the comparison of the Δg differences observed by the gravity meter with the Δg differences calculated from the gradient values in accordance with Eötvös' method divided by the elevation differences of the two stations. When the two points of observation are at the same elevation, in an area where great variations of gradients are found it is shown that the calculation of isogams from the gradient values requires the use of third order derivatives. Thus in flat areas, isogams obtained from gravity-meter data are more reliable than those calculated from torsion-balance measurements.—*M. C. R.* and *R. G. H.*

11685. Hofmann, Walter. Über Anwendung einer Formel zur Berechnung des Vertical-gradienten der Schwere [A formula for computing the vertical gradient of gravity]: Geofis. Pura e Appl., vol. 14, no. 3–4, pp. 145–162, 1949.

As no instrument is available for direct measurement of the vertical gradient of gravity, and the sensitivity of existing gravimeters is not great enough to determine it by measuring gravity at two sufficiently near points, Evjen has proposed a method which gives the vertical gradient in terms of both the gravity anomaly at the point and the average values of the gravity anomaly about the point. Evjen's calculations assumed the earth's surface to be plane. This is modified to include the entire gravitational effect of the earth. The gravitational potential at a point on the earth's surface is represented as a series of spherical functions, each member containing the radius vector of the point, the angular velocity of the earth's rotation, and the geocentric latitude. From this can be derived the normal vertical gradient $\partial\gamma/\partial h = -(3085.6 + 2.2 \cos 2\phi) \times 10^{-9}$ c. g. s. A relation may also be established for the departure of the vertical gradient at a point of the geoid from this normal value, and this difference can be represented in finite form. Several practical examples and the application of the method to tectonic studies are discussed.—*S. T. V.*

11686. Osclaczky, Szilárd. Die mit einer Drehwaage messbare Massenwirkung eines "zweidimensionalen" Parallelepipeden in der vertikalen Ebene [Gravitational action of a two-dimensional parallelepiped, measurable by the torsion balance in the vertical plane]: Geofis. Pura e Appl., vol. 10, fasc. 5–6, pp. 174–180, 1947.

By a two-dimensional parallelepiped the author means one of infinite length and of varying cross section perpendicular to length. The gravitational potential u of such a body and the derivatives of u are determined only by the shape and the position of the cross section of the parallelepiped. Thus u is a function of only two variables. The torsion balance gives the values of the gradient $\partial^2 u/\partial xz$ and of the curvature $\partial^2 u/\partial x^2$, where x is the horizontal axis and z the vertical. The author considers the plane XOZ as complex and determines the loci of equal gradients and curvatures. The loci are orthogonal circles, if the cross section of the parallelepiped is a rectangle stretching into infinity. These values can also be found when the cross section is deformed into a parallelogram with one side remaining constant.—*S. T. V.*

11687. Tarczy-Hornoch, A. Über die Ausgleichung der Schwerkraftsgradienten [Adjustment of gravity gradients]: Geofis. Pura e Appl., vol. 14, fasc. 1–2, pp. 37–49, 1949.

A new method of adjustments of the measurements made with an Eötvös torsion balance is proposed and discussed in detail. If instead of adjusting the Δg values the gradients of gravity are adjusted, the results will be complete uniformity of isogams, free from discrepancies which result when the usual procedure is followed. The values Δg are not the observed quantities, but are functions of the distances and functions of different degrees of accuracy.

In deriving the corrections the differential equations of potential theory are replaced by difference equations and written $\Delta g = \text{gradient}_x \Delta x + \text{gradient}_y \Delta y + (\partial^2 u/\partial z^2)\Delta z$. The term $\partial^2 u/\partial z^2$ can be replaced by the normal variation of the gravitational force, equal to $2g/r$, where r is the radius of the earth. Introducing into this equation the observed values of the gradients and of x and y obtained at different stations during the survey, a system of equations is obtained which makes possible the evaluation of the most probable corrections to be applied. A complete example is included.—*S. T. V.*

11688. Morelli, Carlo. Sulla revisione dei capisaldi per le misure di gravita [On the revision of standards in gravity measurements]: Annali Geofis., vol. 2, no. 1, pp. 67–73, 1949.

Precise gravity measurements in recent years have indicated that the international reference system based on Potsdam determinations is in error by about +14 milligals.—*S. T. V.*

11689. Morelli, Carlo. Ulteriori elementi a sostegno di una correzione per i valori gravita [Latest data in favor of a correction to gravity values]: Annali Geofis., vol. 1, no. 1, pp. 83–86, 1948.

Determinations of gravity at Washington and Teddington and the author's work on the compensation of gravity values for different states of the international network indicate that a correction of -0.015 cm. sec.$^{-2}$ should be applied to the Potsdam value of gravity.—*S. T. V.*

11690. Cagniard, Louis, and Goudey, Raoul. Sue une comparaison indirecte des valeurs de référence admises pour l'intensité de la pesanteur à Paris et à Potsdam [On an indirect comparison of the reference values adopted for the intensity of gravity at Paris and Potsdam]: Acad. Sci. Paris Comptes Rendus, vol. 229, no. 18, pp. 896–897, 1949.

As topographic corrections at the Luxembourg stations Athenée and Couvent are uncertain because of inadequate maps, a North-American gravimeter was used to measure gravity values at Luxembourg-Artisans and Metz-Couvent relative to Paris, and observed values compared with German pendulum determinations at the same stations. The substantial agreement between gravity determined for these stations with reference to Paris (980.9773 and 980.9441 gals respectively) and to Potsdam (980.9772 and 980.9446 gals respectively) shows close similarity between the Paris and the Potsdam gravity systems.—*V. S.*

11691. Jones, L. Le levé gravimetrique de la Belgique 1947–1948 [Gravimetric survey of Belgium 1947–1948]: Soc. belge géologie Bull., vol. 59, no. 3, pp. 568–595, 1949.

A gravity survey of Belgium was made during 1947–48, using the Nørgaard gravimeter as the principal instrument. The total length of profiles covered was more than 16,000 km. and 380 stations were occupied. Final readings at each station were reduced to sea level and the free air anomaly computed. The normal value of gravity for the station was taken from the 1930 International Cassinis' formula. The Bouguer reduction was computed using density values ranging from 2.1 to 2.65 in accordance with the geologic structure. From the computed data maps of anomalies were drawn on a scale of 1=320,000 with 5-milligal contour intervals. A copy of the complete map, reduced size, is included.—*S. T. V.*

11692. Thirlaway, H. I. S., and Cook, A. H. Recent observations of gravity in Wales and the Borders [abstract]: Internat. Geol. Cong., Great Britain, 18th Sess., Titles and abstracts of papers, p. 30, 1948.

A gravity survey of the Welsh borders, was conducted during 1947–48 using a Graf gravimeter at 600 stations. A general positive Bouguer anomaly of 5 to 10 mgal. in the plateau of central Wales is 15 to 20 mgal. greater than would result if the area were isostatically compensated. The excess mass seems to be supported by the strength of the crust, and the positive anomaly seems to coincide with the region of post-Cretaceous rejuvenation. In the Worcester basin the line of the Malverns divides the zone of positive anomaly from a deep anomaly trough with a minimum of −30 mgal. near Worcester. The gravity field may be explained by a series of faults striking north with a total downthrow of 8,000–10,000 feet. The trough is also well defined to the north and northeast and apparently it is mainly filled with Triassic rocks. In general, the pattern of the gravity field in the Welsh borders has a Caledonian trend.—*V. S.*

11693. Woollard, G. P. Regional gravity study of the Appalachian Mountain system [abstract]: Geol. Soc. America Bull., vol. 60, no. 12, pt. 2, p. 1932, 1949.

A regional gravity network of several thousand observations has been established over the Appalachian Mountain system in an area between the Gulf of Mexico, the Allegheny Mountain front, and the Atlantic Coast. Bouguer anomalies indicate two dominant major gravity structures, a pronounced gravity minimum strip and an associated maximum strip, which parallel each other and the visible geologic structure. The anomalies are attributed to a thickening and thinning of the upper crust. In the mid-Appalachian area the gravity minimum is about −80 mgal. and the gravity maximum about +40 mgal. With a density contrast of 0.3 between upper granitic and lower more basic crustal material, a relief of about 9.5 km. is indicated on the base of the granitic layer. To the north the gravity pattern merges in southern Quebec with a similar pattern following the St. Lawrence River valley, and in the far south dies out just beyond the Coastal Plain overlap. Structural trends of the Appalachian and Ouachita provinces indicated by gravity appear to intersect at right angles. Structural syntaxis, if any, is similar to that at the junction of the arcs of the Kuril Islands [Chishima-rettō] and Aleutian Islands.—*M. C. R.*

MAGNETISM[2]

11694. Akademii͡a Nauk SSSR Vestnik. The new magnetic observatory [in Russian]: no. 7, pp. 116–117, 1949.

A new geomagnetic observatory has been recently established near Moscow for study of very small variations of the terrestrial magnetic field related to solar processes and to processes in the earth's crust. The main instrument of the observatory is a special induction coil of 100 meters diameter, composed of 38 turns, connected to a fluxmeter provided with a phototube and a recording apparatus. The sensitivity of this installation is about 1 mm. for 8 milligamma or for 8×10^{8} oersted.—*S. T. V.*

11695. Konakhovich, I͡U. I͡A., Latyshev, G. D., and Tsimbalin, V. V. The measurement of the magnetic field by the induction method [in Russian]: Akad. Nauk SSSR Izv., ser. fiz., vol. 13, no. 4, pp. 456–464, 1949.

The ballistic method most commonly used in measurements of the intensity of magnetic fields is not adapted for continuous observation of the field. Each measurement being a discrete datum, necessitates the application of many corrections to the readings, and the limit of the error in a measurement is not less than 1/1000. Magnetic field intensity may be determined by measuring the e. m. f. generated in the coil of a special rotor placed in the magnetic field to be investigated. Generation of the stable frequency of rotation required by the method was achieved by using a quartz strip with a natural frequency of 50 kilohertz as the controlling frequency source.

This frequency was decreased 800 times in a six-cascade electronic scheme with 50 khz. as the initial frequency; 25 khz. frequency in the second step; 5 khz. in the third; 1250 hertz in the fourth; 250 hz. in the fifth and 62.5 hz. in the last cascade.

The current of this frequency, remaining stable in the measure of the initial source, feeds a selsyn motor driving the test rotor with a constant speed. The electromotive force generated in it is proportional to the intensity of the investigated magnetic field. Best results are obtained with a capacity of about 60μ F inserted in series before the driving motor, which creates in its stator a rotating magnetic field instead of the pulsating one. The electromotive force generated is measured by the compensation method, using a Raps' potentiometer.

Advantages of the method are the very high accuracy of the measurement, (in the experimental instrument it was 1×10^{-5} which can be increased by placing the first step of the controlling frequency in a thermostat), and the possibility of continuous observation of the magnetic field.

The absolute error of the measurement with a magnetic field intensity of 500 oersted is 4×10^{-5}; the relative value of the error decreases with increasing intensity and is limited only by the stability of the frequency.

A detailed description of the instrument is given as well as the wiring diagram of the set-up. Further improvements of the proposed method can be achieved by introducing photo-elements into the measuring scheme.—*S. T. V.*

11696. Petrova, G. N. Interior demagnetizing factor [in Russian]: Akad. Nauk SSSR Izv., Ser. geog. i geofiz., vol. 13, no. 4, pp. 363–368, 1949.

If a specimen is brought into a magnetic field it becomes magnetized and creates its own field opposite in direction and proportional to the intensity of magnetization. The factor of proportionality determining this secondary field, the exterior demagnetization factor, is determined by the properties of the substance and the surrounding medium. If a sample of polycrystalline substance is placed in a closed magnetic field, the exterior demagnetization factor is zero but inside the substance the component parts having differently oriented fields decrease the total field intensity by a factor, termed the interior demagnetization factor, determined by the physical structure of the crystalline substance. This factor can be determined experimentally from the angle formed by the inclination of the hysteresis loop with the abscissa axis. Thus in studying magnetic properties of minerals it is necessary to distinguish between the average intensity of magnetization, the true intensity, and the intensity of the produced field.

---

[2] See also Geophys. Abstracts 11812 to 11819.

In polycrystalline substances, the intensity of magnetization can be quite different in individual grains. Relations determining the intensity of magnetization in different component parts of the specimen are derived and the values of the interior demagnetizing factor are computed for varying percentages of individual grains in the substance. A formula is given for determining the average susceptibility of the specimen from its ferromagnetic components.—*S. T. V.*

11697. Hales, A. L., Wijk, A. M. van, and Gough, D. I. The magnetic field of the earth: South African Science, vol. 2, no. 10, pp. 214–215, 1949.

P. M. S. Blackett's formula for the relation observed between magnetic moment and angular momentum in massive rotating bodies is shown to lead to incorrect results. The equation obtained when it was used to calculate the decrease of horizontal magnetic intensity at a certain depth below the surface of a plateau of a given height above mean sea level indicated that, if the same argument were applied to the earth rotating around the sun, there would be a diurnal variation of field approximately 300 times the earth's field, which cannot be correct.

Other direct tests of theories of the origin of geomagnetism, by the measurements of the variation with depth of both the horizontal and the vertical geomagnetic component at Blyvooruitzicht, are reported. Such measurements should be made in a mountainous region which is known to contain no magnetic bodies.—*V. S.*

11698. Singer, S. F., Maple, E., and Bowen, W. R., Jr. Measurement of the earth's magnetic field at high altitudes at White Sands, New Mexico: Phys. Rev., 2d ser., vol. 77, no. 3, pp. 398–399, 1950.

An Aerobee rocket containing a total field magnetometer fired at White Sands on April 18, 1948 reached a height of 372,000 ft. Telemetered data gave values of the magnetic field during flight with an estimated over-all accuracy of 1.0 milligauss or better. The principal results were: confirmation that the field strength decreases with altitude in accordance with calculations based on potential theory, the experimental data agreeing within 2 milligauss with the inverse cube relation; lack of evidence for or against the existence of circulating current sheets in the upper layers of the atmosphere because of the small effect at the latitude of the experiment.—*M. C. R.*

11699. Tschu, K. K. On the practical determination of lunar and luni-solar daily variations in certain geophysical data: Australian Jour. Sci. Research, ser. A, vol. 2, no. 1, pp. 1–24, 1949.

The application of the method proposed by Chapman and Miller to the determination of lunar and luni-solar daily variations in geophysical elements where these variations are overlaid by larger solar daily and irregular variations is described. Included among such luni-solar changes are the ionospheric electric currents induced by the lunar tide in the ionosphere owing to the tidal motion of the air across the earth's magnetic field. These currents are revealed by variations of the geomagnetic field and also in the earth potential and earth currents induced thereby. Examples of the calculations are given.—*S. T. V.*

11700. Slaucitajs, Leonids. Über die erdmagnetischen anomalien in den Gebieten um die Ostsee [Geomagnetic anomalies in the regions surrounding the Baltic Sea]: Geofis. Pura e Appl., vol. 15, no. 1–2, pp. 60–62, 1949.

The area around the Baltic Sea is known to be intensely magnetically disturbed. A map of the area shows the most important vertical component anomalies as great as +2,000 and +5,000 gammas found here by different investigators. For the geological interpretation of these anomalies a reference is made to numerous studies of this question.—*S. T. V.*

11701. Bossolasco, Mario. Suscettivita magnetica di alcuni minerali di magnetite [Magnetic susceptibility of some minerals of the magnetite group]: Geofis. Pura e Appl., vol. 12, pp. 53–60, 1948.

The magnetic susceptibility of rock samples from various ore deposits of Italy was measured using the method of G. Grenet. The results are presented in a short table.

The author finds, as did Sture Werner from his investigation of minerals in Sweden, that magnetic susceptibility varies within wide limits even with the same percent of magnetite content of rocks. Only in samples taken from the same deposit is it possible to establish a correlation between magnetite content and the magnetic susceptibility of a sample.

These results suggest caution in evaluating magnetic properties of a sample from its magnetite content or in estimating the probable iron content of a deposit from the susceptibility of the corresponding samples.—*S. T. V.*

11702. Roche, Alexandre. Sur les caractères magnetiques du système éruptif de Gergovie [The magnetic characters of the Gergovie eruptive rocks]: Acad. Sci. Paris Comtes Rendus, tome 230, no. 1, pp. 113–115, 1950.

From measurements of the vertical anomalies and determination of the permanent magnetization and susceptibility of samples from different parts of the area it is concluded that the eruptive system can be divided, magnetically, into three zones: dikes, necks, and sills on the eastern slope with strong negative anomalies and permanent magnetization opposite to the present earth's field; an upper layer forming the summit of the plateau characterized by a positive anomaly and permanent magnetization in the direction of the present earth's field; a lower part of the plateau with anomalies of different signs and magnitude and strong dispersion of the magnetization. This suggests the summit rocks are independent of the eastern eruptive group and that the dikes, necks, and sills were all emplaced at the same time. It is believed improbable that magnetization as constant as observed in the latter group could result from mineral alteration, and hence it must have been imposed at the time of emplacement.—*M. C. R.*

11703. Torreson, O. W., Murphy, Thomas, and Graham, J. W. Magnetic polarization of sedimentary rocks and the earth's magnetic history: Jour. Geophys. Research, vol. 54, no. 2, pp. 111–129, 1949.

Magnetic polarization of 99 samples of flat-lying, undisturbed sedimentary rocks, mostly Eocene to Pliocene in age with a few of Jurassic age, from eight sites in western United States have been measured. The direction of polarization in the plane of bedding (declination) in two-thirds of the samples fell within a narrow range centering on geographic rather than geomagnetic north, 13° to 22° east of geographic north at the sites sampled. The dip or inclination of polarization in two-thirds of the samples fell within a small range centering on 63°, in relatively good agreement with the present average 69° inclination at the sites sampled. These results are consistent with the idea that for 50 million years or so the polarity of the earth's magnetic field has been the same as now and the average orientation of the magnetic axis has coincided with the earth's geographic axis.—*M. C. R.*

SEISMOLOGY

11704. Leet, L. D. Earth waves, 122 pp., Cambridge and New York, Harvard University Press and John Wiley and Sons, 1950.

The transmission of earth waves and methods of measuring and observing them are summarized with particular reference to applications of such knowledge in geophysical prospecting, measuring vibrations from dynamite blasts, and studying hurricanes.—*M. C. R.*

11705. Milne, W. G. Bibliography of seismology: Dominion Observatory Ottawa Pubs., vol. 14, no. 5, pp. 97–133, 1950.

Items 7004 to 7131, January to June 1949 and a complete bibliography of Japanese seismological works since 1939 compiled by Kawasumi are listed.—*M. C. R.*

11706. McKim, V. C. The history of the seismological station at Fresno, California: Seismol. Soc. America Bull., vol. 39, no. 4, pp. 239–242, 1949.

Seismological observations at Fresno from 1892 to 1935 by the Weather Bureau and from 1935 to the present at the seismograph station at Fresno State College are summarized.—*M. C. R.*

11707. Ramirez, J. E. New seismic station at Galerazamba, Colombia: Nature, vol. 164, no. 4163, pp. 288–289, 1949.

A seismological station was established at Galerazamba, Colombia in late January 1949. Coordinates of the station are: 10°47′08″ N. lat., 75°15′44″ W. long., height 21 m. above sea level. The station is equipped with two horizontal-component long-period, and one vertical short-period Sprengnether seismometers and a triple recording drum. The geology of the area, construction of the buildings, and proposed studies are outlined.—*M. C. R.*

11708. Tillotson, Ernest. Seismology in Britain: Nature, vol. 163, no. 4143, pp. 500–501, 1949.

A brief account is given of seismological activities during the past decade or so in Britain. Among these are E. R. Lapwood's investigation of the diffraction effects at the surface of a semi-infinite homogeneous elastic medium from a pulse emitted by a buried line source, G. E. R. Deacon's observations of microseisms, P. L. Willmore's moving-coil seismograph with nearly constant response to ground velocities of frequency 2–25 cycles per second and maximum sensitivity of 5,000 cm./cm./sec., and M. N. Hill's long-period inductance-bridge seismograph. Studies of the records of the Helgoland explosion in 1947 and the Soltau explosion of 1946 are also reported.—*V. S.*

11709. Lapwood, E. R. The disturbance due to a line source in a semi-infinite elastic medium: Royal Soc. London Philos. Trans., vol. 242, no. 841, pp. 63–100, 1949.

A solution is given, in terms of double integrals, for the disturbance at any point near the surface resulting when a cylindrical pulse is emitted from a line source buried in a semi-infinite homogeneous elastic medium. Approximate evaluation of these integrals for depths of source and point of reception which are small in comparison with their distance apart allows a description of the sequence of pulses arriving at the point of reception. When this is at the surface and distant from the epicenter, the disturbance is made up of the following pulses, in order of arrival: for initial *P* at the source, *P*, surface *S*, and Rayleigh; for initial *S*, surface *P*, *S*, and Rayleigh. If the initial pulse has the form of a jerk in displacement, both *P* and *S* arrive as similar jerks, but the Rayleigh pulse is blunted. Surface *P* takes a minimum-time path and arrives with a jerk in velocity, but surface *S* is confined to the neighborhood of the surface and arrives as a blunted pulse. It is shown also that when the sharp *S*-pulse of ray theory is converted to a blunted pulse by the presence of surface *S* and the spreading of *S*, the duration of this composite pulse is approximately that of the observed scatter of readings of S_g and similar waves from near earthquakes.—*M. C. R.*

11710. Riznichenko, I͡U. V. Seismic quasi-anisotropy [in Russian]: Akad. Nauk SSSR Izv., ser. geog. i. geofiz., vol. 13, no. 6, pp. 518–544, 1949.

The propagation of elastic waves through media consisting of parallel and isotropic layers is analyzed. Such a medium has certain features of anisotropy, the velocity of wave propagation being different in different directions, but the entire medium cannot be treated as one anisotropic layer. This necessitates the use of a special term—"quasi-anisotropic medium." The elastic properties in different directions of such a stratified medium are characterized by different coefficients of anisotropy, defined as the ratios of: the effective velocity, as determined by the travel time curve, to the average velocity; the velocity in a certain stratum to the boundary velocity of the same stratum; and the velocity in the direction perpendicular to the strata to that parallel to them. Only longitudinal elastic waves are considered.

In the last case the coefficient of quasi-anisotropy varies with the length of the propagating waves. With long waves the distinction between a simple anisotropic medium and a stratified, quasi-anisotropic one is especially noticeable.

Sufficiently accurate results for the first two conditions can be obtained by the methods of geometrical optics, whereas the problem of determining the ratio of the velocities perpendicular and parallel to the strata requires a special analysis. As the first step the elastic properties of the medium are determined in two perpendicular directions. The corresponding moduli are found from the system of equations of strain, obtained for each layer and from the corresponding boundary conditions, along each boundary plane stresses being equal in the points of adjoining layers. The method used is similar to that for determination of dielectric constants of a stratified medium.

From the moduli of elasticity corresponding to the principal directions, it is possible to compute the corresponding velocities of propagation. Only approximate values of these velocities are given, but their accuracy is satisfactory for the problems of applied seismology. In the case of waves which are long compared to the thickness of the strata the error is negligible.

Precise expressions and approximate formulas for different moduli of elasticity which are sufficiently accurate for many practical applications are given. Changes in the derived formulas for various wave lengths are computed. For certain wave lengths, the coefficients of quasi-anisotropy become important and cannot be neglected in seismic exploration.—*S. T. V.*

11711. Price, W. J., and Huntington, H. B. Acoustical properties of anisotropic materials: Acoustical Soc. America Jour., vol. 22, no. 1, pp. 32–37, 1950.

Theoretical and experimental investigations on the propagation of elastic waves through anisotropic media are briefly reported. The pulsed ultrasonic method was used in the experiments and measurements were made on small crystals cut from different substances.

It was found that for any given direction of the normal to a wave front there are, in general, three possible modes of propagation. The corresponding possible displacements of a particle are mutually perpendicular, but these displacements are not necessarily parallel or perpendicular to the wave normal. Transfer of energy between the modes of propagation can occur for certain cases of normal reflection. A phenomenon analogous to optical birefringence sometimes occurs, when the energy does not travel in a direction parallel to the wave normal.—*S. T. V.*

11712. Maecker, H. Quantitativer Nachweis von Grenzschicht wellen in der Optik [An analytical proof of the existence of boundary waves in optics]: Annalen der Physik, 6 Folge, Band 4, Heft 8, pp. 409–431, 1949.

Mintrop's waves are generated and can be observed when an elastic wave is totally reflected at the boundary between two layers, the lower of which has the higher velocity of propagation. The refracted wave spreads along the boundary line with a higher velocity and arrives at the surface, beyond a certain distance, together with the direct and the simply reflected waves.

Experimental arrangements are described which make possible the observation of such waves, and numerous photographs illustrate the details. A theoretical analysis is presented which establishes the conditions of appearance of boundary waves. Optical phenomena are discussed primarily, but several analogies are quoted from seismology.—*S. T. V.*

11713. Takahashi, Ryutaro, and Hirano, Kintaro. A new horizontal-component seismograph for comparison observations [in Japanese with English summary]: Tokyo Imp. Univ. Earthquake Research Inst. Bull., vol. 19, no. 3, pp. 527–533, 1941.

A horizontal component seismograph of the inverted pendulum type was designed for the greatest possible accuracy and ease of manipulation. All jewels were made to press lightly on pivots by means of flat springs which eliminated backlash between the pivot and the jewels. The helical spring and the needle system were replaced by a connecting rod with pivots and flat springs at both ends. The air damper consists of a pendulum bob, which acts as a piston, covered with two cylinders which are provided with wide clearance to facilitate the adjusting of the instrument and eliminate the rubbing of the piston on the cylinder walls. The geometrical magnification of the seismograph is 47.5 and the natural period is 8.0 seconds. The velocity of the recording paper is 12 centimeters per minute. Four such seismographs, when installed parallel to each other, gave identical records. Two drawings of the new seismograph and 21 sample records are included.—*S. T. V.*

11714. Rouaud, André. Sur la détermination des constantes des séismographes électromagnetiques [Determination of the constants of electromagnetic seismographs]: Annales Géophys., vol. 4, no. 2, pp. 124–160, 1948.

The determination of the constants of electromagnetic seismographs when the periods of the pendulum and the galvanometer are different is investigated. The particular case chosen for analysis is that in which the roots of the characteristic equation of the coupled pendulum-galvanometer system are close to the quadruple root, so that a development in limited series is possible within a close range of the root. The relations found are generalizations of Rybner's for equal or nearly equal periods. Examinations of the case of nearly equal periods results in the same formulas as Rybner's. Approximate formulas are given for the rapid determination of constants in this last case.—*M. C. R.*

11715. McComb, H. E., Neumann, Frank, and Ruge, A. C. The determination of true ground motion from seismograph records: U. S. Coast and Geodetic Survey Special Pub. 250, 52 pp., 1949.

A reprint of "The determination of true ground motion by integration of strong-motion records: A symposium" in Seismol. Soc. America Bull., vol. 33, no. 1, 1943.—*M. C. R.*

11716. Byerly, Perry, Mei, A. I., and Romney, Carl. Dependence on azimuth of the amplitudes of *P* and *PP:* Seismol. Soc. America Bull., vol. 39, no. 4, pp. 269–284, 1949.

The *PP/P* amplitude ratio has been used to infer second order discontinuities in the earth and also to distinguish Pacific and continental structures. The displacement of a point at the surface of the earth produced by body waves from a distant source depends on several factors. The effect of the factor which depends on the energy radiating from the source is investigated here. By an extension of Nakano's work on the correlation of first motion in *P* with direction of forces at the focus it is shown that the ratio of *PP/P* is a function of the azimuth from a fault source for certain kinds of movement. It is concluded that the ratio *PP/P* depends on too many factors to be useful in determining any one of them.—*M. C. R.*

11717. Agamennone, Giovanni. La profondita del foco dedotta dall' angolo d'emergenza delle onde sismiche [Depth of focus derived from the angle of emergency of seismic waves]: Geofis. Pura e Appl., vol. 12, pp. 108–112, 1948.

The suggestion of several seismologists that the depth of focus of an earthquake be determined by measuring the angle of emergence of the first seismic wave is critically analyzed. This method requires knowledge of the exact amplitudes of the first phase, P_g or P, from which must be calculated the amplitude and the direction of the displacement of the ground, the apparent angle of emergence and then the true angle. It is also necessary to know the travel times for the arrival of the same wave from the focus to several other seismic stations, located as near as possible to the epicenter, in itself a very serious limitation of the method. Finally it must be assumed that the incident seismic wave everywhere in its path from the focus to the point of observation is propagated through homogeneous formations, an assumption very seldom justified.

Determinations of the focal depth of different earthquakes by this method and by other means are compared and the inaccuracy of the method noted. Its use is recommended only in the absence of other necessary data.—*S. T. V.*

11718. Bath, Markus. Travel times of the principal earthquake waves for Uppsala: Uppsala Univ., Geol. Inst. Bull., vol. 32, pp. 105–130, 1948.

Travel times of *P*, *S*, *PP*, *SS*, *L*, and *M* waves have been determined from 315 records of normal or shallow earthquakes with a mean focal depth of 17 km. obtained during 1913–43 on a Wiechert 1,000-kilogram horizontal seismograph at the Meteorological Institute of Uppsala, Sweden. Epicenter data were taken from the related studies and tables of Gutenberg and Richter, Jeffreys and Bullen, as well as from some other data. The study contains extended tables, indicating differences of travel time obtained for various phases; it gives also an evaluation of the accuracy of the method of the analysis. A comparison of the travel times of the seismic waves arriving at Uppsala from different quadrants showed no appreciable difference for the body waves, but a striking difference for *L–O*, indicating the greatest velocity in the northwest and southwest quadrants and the smallest in the northeast and southeast quadrants. The former velocity was 4.21 km./sec, the latter 3.91 km./sec.—*S. T. V.*

11719. DiFilippo, Domenico. Il terremoto delle Azzorre del 25 November 1941. [The Azores earthquake of November 25, 1941]: Annali Geofis., vol. 2, no. 3, pp. 400–405, 1949.

The coordinates of the epicenter of the earthquake have been determined as 37°25′41″ N. lat., 19°00′65″ W. long., and the time of origin as $18^h03^m54.7^s$ G.c.t. The method of Caloi and Peronaci was used, in which approximate values of the unknowns are introduced into the equation defining the azimuth of the epicenter in the spherical triangle formed by the North Pole, the point of the observation and the epicenter of the earthquake, and the corresponding corrections are computed as partial derivatives. Seismograms from 36 observatories were used and the final values were determined by the method of least squares.—*S. T. V.*

11720. Inglada Ors, Vicente. Nota sobre la profundidad hipocentral del sismo del Apenino Toscano-Romañol de 11 Febrero de 1939 [A note on the depth of focus of the earthquake in the Tuscany-Romagna region of the Apennines, February 11, 1939]: Geofis. Pura e Appl., vol. 12, pp. 181–189, 1948.

A depth of focus of 7 km. for this earthquake was determined, using Koveslighety's method, which is based on the measurement of the areas enclosed by successive isoseismal lines and the determination of the equivalent circular areas and their radii. This compares favorably with the depth of 7–10 km. obtained by Caloi from a study of Italian seismograms.—*S. T. V.*

11721. Hayes, R. C. Earthquakes in New Zealand during the year 1947: New Zealand Jour. Sci. Technology, sec. B, vol. 30, no. 2, pp. 102–105, 1948 (1949).

Epicenters, times of origin, and maximum felt intensity of all earthquakes located in the New Zealand area are tabulated and shown on a map.—*M. C. R.*

11722. Lemcke, Kurt. Zur Tectonik des Erdbebengebietes der Hohenzollernalb [On the tectonics of the seismic region of the Hohenzollernalb]: Neues Jahrb. für Mineral., Geologie und Paläontology, Abt. B, Heft 1–3, pp. 20–25, 1949.

Observations during 1946 on the seismicity of the Hohenzollernalb partly complete, partly modify knowledge of the tectonics of this region. The existence of the Hohenzollern graben is confirmed. Other dislocations, genetically independent of the graben, were discovered. The most important of these is the fault running along the Schmicha brook with a vertical displacement of 30–35 meters. Several other faults show a throw up to 45 meters. The source of earthquakes often observed in this region is now attributed not to faulting of the Hohenzollern graben, but to the newly discovered faults, an explanation which is in better agreement with seismic observations.—*S. T. V.*

11723. Valle, P. E. Sull' interpretazione dei sismogrammi tra 80° e 120° [Interpretation of seismograms between 80° and 120°]: Soc. Sismol. Italiana Boll., vol. 40, no. 1–2, 1942. Reprinted as Ist. naz. geofis. Rome pub. 103.

From experimental data curves are drawn for *SKS–P*, *S–P*, and *S–SKS* between 80° and 120°. Tables at 0.5° intervals show the differences between these curves and Macelwane's.—*M. C. R.*

11724. Montandon, Frédéric. Sur les ondes séismiques du tremblement de terre valaisan de 1946 [On the seismic waves of the Valais earthquake of 1946]: Soc. phys. et histoire nat. Genève Archives Sci., vol. 2, fasc. 1, pp. 192–196, 1949.

Superposition of E. Wanner's isoseismal lines for the four principal shocks of 1946 in the Valais, Switzerland, on N. Oulianoff's sketch of local geology, inferred from seismographic data of Swiss stations for the earthquake of January 25, 1946, shows that the four isoseismal contours form loops extended northwardly over the supposed three adjacent structures, the Mont Blanc-Vosges anticline, the Sierre-Berne-Delémont-Mulhouse syncline, and the Aar-Black Forest anticline. Three project in tongue-like fashion along the syncline, as if squeezed between the two anticlines, indicating greater intensity in the syncline, where sediments would be thick, than in the anticlines, where they would be thinner. Surface evidence supports Oulianoff's thesis that the Mont Blanc massif, the Vosges, the Aar, and the Black Forest massifs are connected by granitic anticlines at depth (*see* Geophys. Abstracts 137, no. 11083).—*V. S.*

11725. Nagata, Takeshi. Summary of the geophysical investigations on the great earthquake in southwestern Japan on December 21, 1946: Am. Geophys. Union Trans., vol. 31, no. 1, pp. 1–6, 1950.

Geophysical studies of the earthquake are summarized briefly. According to Kawasumi, the magnitude of the earthquake determined from the distribution of seismic intensity was 6.5, corresponding to a total seismic energy of 10^{26} ergs. Precise leveling surveys show that deformation of Muroto Peninsula [Muroto-hantō] from 1895 to 1935 had been an inclination in the direction S. 10° E. with almost constant velocity, the total tilt amounting to 1.4 seconds. The change accompanying the present earthquake was exactly opposite in sense. Generally speaking, however, the peninsula is again tilting southward. Crustal movement of the sea bottom which caused the tsunamis apparently also involved a wide area.—*M. C. R.*

11726. Oulianoff, Nicolas. Seismologie et structure du soubassement des Alpes [Seismology and the structure of the sub-basement of the Alps], abstract: Internat. Geol. Cong., Great Britain, 18th Sess., Titles and abstracts of papers, p. 28, 1948.

The Swiss earthquake of January 25, 1946, was recorded by the Neuchâtel, Basel, Zürich, Chur stations—near the epicenter and disposed fan-wise relative to it. Analysis of the records enabled the author to show that the granitic cores of the ancient Mont Blanc and Aar massifs have a north-south orientation, confirmed the hypothesis that there are direct connections between the Mont Blanc and the Vosges and between the Aar and the Black Forest, and that these two ancient ridges are separated by a depression formed before Alpine folding. It was also established for the first time seismologically that there are within the crust structures which are separated by vertical surfaces.—*V. S.*

11727. Gutenberg, Beno. Structure of the earth's crust in the continents: Science, vol. 111, no. 2872, pp. 29–30, 1950.

Discrepancies between results from studies of earthquake waves and those from artificial explosions are beyond the limits of error. The following interpretation is proposed: material below the sediments has a velocity of about 6 km./sec. for longitudinal waves which increases with depth and approaches 7 km./sec. at a depth of 10 km. At approximately 15 km. depth the velocity decreases, either abruptly or gradually, with a minimum of about 5½ km./sec. at 20–25 km. Below this, it again increases, possibly suddenly, and again increases suddenly to 8.1 or 8.2 km./sec. at the Mohorovičić discontinuity. In artificial explosions the waves refracted through the surface layers with relatively high velocities are recorded but waves reaching the lower velocity layer are refracted downward. The source of most shallow earthquakes would be in the low velocity layer. Rays starting not too far from horizontal could not leave the low-velocity layer in accordance with ray optics and thus could form a "sofar channel". Energy radiating from the channel would form the *P* phase. Unpublished work by Richter is in excellent agreement with the new hypothesis.—*M. C. R.*

11728. Gutenberg, Beno. Properties of the earth's crust beneath the oceans [abstract]: Geol. Soc. America Bull., vol. 60, no. 12, pt. 2, p. 1892, 1949.

There are two major units of the earth's crust, one consisting of the continents and the bottom of the Indian and Atlantic Oceans, with andesitic crustal material, and the second the Pacific basin with possible outlying areas in the Caribbean, southern Antilles and Arctic regions, with younger eruptive basaltic rocks. Geophysical evidence for the discontinuity between these units consists of great ocean deeps, negative gravity anomalies, and shallow earthquakes, followed on the continental side by zones of intermediate earthquakes and active volcanoes, and deep earthquakes. Other evidence for the difference in structure includes the higher velocity in the Pacific basin for 20-second surface waves, the loss of energy in surface waves travelling along the Pacific boundary, the smaller amplitudes of longitudinal waves reflected under the Pacific, the occurrence of 80 percent of all earthquakes in the circum-Pacific belt, and the lack of shocks in the interior of the Pacific basin in contrast to the Atlantic and Indian Oceans.—*M. C. R.*

11729. Ewing, Maurice. Seismic studies in ocean basins [abstract]: Geol. Soc. America Bull., vol. 60, no. 12, pt. 2, pp. 1885–1886, 1949.

Seismic refraction measurements in the North Atlantic in general show that basement rocks in which longitudinal waves have a velocity of 7.6 km./sec. underlie approximately 2 km. of unconsolidated sediments. Reflection measurements over large areas, including the approaches to continents, main basins, and central highland of the mid-Atlantic Ridge, cannot yet be interpreted as indicating reflecting surfaces which are continuous over distances of tens of miles. On the eastern and western flanks of the Ridge and throughout the Bermuda Rise, however, it is possible to map a buried reflecting surface, probably the top of the basement, which is continuous over hundreds of miles at depths to 4,000 feet. Absence of intervening reflections indicates a remarkable homogeneity of the overlying sediments.

A proposed new theory of surface wave dispersion under oceans can be interpreted to indicate that seismic refraction results are valid for most if not all of the Atlantic and Pacific Ocean basins. If this conclusion is accepted, it is strong evidence that the ocean basins have never stood higher with respect to the continents than at present, and land bridges, if they existed, must have been very narrow.—*M. C. R.*

11730. Ewing, Maurice, Worzel, J. L., Hersey, J. B., Press, Frank, and Hamilton, G. R. Seismic refraction measurements in the Atlantic Ocean basin: Geol. Soc. America Bull., vol. 60, no. 8, p. 1303, 1949.

A reversed seismic refraction measurement at 34° N. lat., 66°30′ W. long. indicated the ocean floor there consisted of two layers. A velocity of 24,800 ft./sec. (7.58 km./sec.) was found for the second layer. The velocity in the upper layer was assumed as 5,600 ft./sec. (1.70 km./sec.), indicating a thickness of 4,500 ft. for the sedimentary layer. The granitic and intermediate layers are thus apparently lacking.—*M. C. R.*

11731. Hill, M. N., and Swallow, J. C. Seismic experiments in the Atlantic: Nature, vol. 165, no. 4188, pp. 193–194, 1950.

Experimental observations were made in August 1949 near 53°50′ N. lat., 18°40′ W. long. in water approximately 1,300 fathoms deep. Depth charges set to fire at 900 feet were detected by quartz hydrophones suspended 150 feet below sono-radio buoys which transmitted information from the recording instrument to ship. Preliminary calculation of results indicates two interfaces, at depths of 7,700 and 16,800 feet. Velocities of 6,900, 6,400, and 7,300 ft./sec. in the uppermost layer, 16,300, and 17,300 ft./sec. in the intermediate layer, and 21,700 and 20,600 ft./sec. in the lowest medium were observed at different locations. The first layer is believed to be sediments which are not highly consolidated. The second may be granite or may also be early Paleozoic sediments as the thickness is much less than the granitic layer of the continents.—*M. C. R.*

11732. Morelli, Carlo. Studio di alcune esplosioni subacquel nel Golfo di Trieste [Study of submarine explosions in the Gulf of Trieste]: Annali Geofis., vol. 2, no. 1, pp. 113–136, 1949.

Explosives detonated on the sea bottom at distances of 3–10 kilometers and in a marble quarry 16 kilometers from the Trieste seismograph station were recorded by the Wiechert and Alfani instruments as well as the Geiger accelerometer. The velocities of *P* and *S* waves were determined as 2,680 and 1,720 meters per second respectively. Strong amplitudes of the direct longitudinal waves were observed in the water at short distances from the shot points. Rayleigh-type surface waves were found at the boundary of the water-ground system as predicted by the theory of Press and Ewing.—*S. T. V.*

11733. Raitt, R. W. Studies of ocean-bottom structure off southern California with explosive waves [abstract]: Geol. Soc. America Bull., vol. 60, no. 12, pt. 2, p. 1915, 1949.

Sediment thickness and basement velocity in the Pacific Ocean area between Point Eugenia and Santa Cruz Island and extending 800 nautical miles west of

San Diego have been studied by reflection and refraction methods. TNT bombs were used as sound sources, and recording was by pressure-actuated crystal hydrophones.

Beyond the continental slope, in water about 2,000 fathoms deep, the sediment thickness was a few hundred meters, and the basement velocity approximately 6.5 km./sec. One 60 km. reversed profile indicated that the velocity increases to 8 km./sec. at a depth of about 5 km. beneath the basement surface. A strong second arrival with a velocity of 3.6 km./sec. may be a basement shear wave.

Inside the continental slope the greatest sediment thickness observed was about 3 km. in Santa Cruz basin, where water depth is 1,050 fathoms. Basement velocities range from about 4.5 km./sec. near land, where metamorphic rocks outcrop, to 6.3 km./sec. beneath Santa Cruz basin.—*M. C. R.*

11734. Willmore, P. L. Seismic experiments on the North German explosions, 1946 to 1947: Royal Soc. London Philos. Trans., ser. A, vol. 242, no. 843, pp. 123–151, 1949.

Observations of seismic waves at distances up to 50 km. from the Soltau explosion, and between 50 to 1,000 km. from the Helgoland explosion indicate an average velocity for the first arrivals of 4.4 km./sec. between 4 and 24 km. from the shot point, 5.95 km./sec. between 24 and 120 km., and 8.18 km./sec. beyond 120 km. Significant local variations were found at the shorter distances. Alternative hypotheses of the distribution of velocity in the upper layers gave estimates of 27.4 and 29.6 km. for the depth of the ultrabasic layer. P^* was not significantly recorded, but several onsets 7 or 8 sec. after P_n may have represented a wave travelling for most of its path in the ultrabasic layer and reflected at the critical angle between that layer and the surface. It was not clear whether the onsets close to the expected time of P_g should be treated as one or more phases. Confused motion persisted during the period when transverse waves were expected, but, with the possible exception of S_n, there was no significant concentration of observations about lines representing recognized phases.

The thermal energy of the Helgoland explosion was 1.3×10^{20} ergs, and the energy in the seismic waves was of the order of 10^{17} ergs.—*M. C. R.*

11735. Benioff, Hugo. Seismic evidence for the fault origin of oceanic deeps: Geol. Soc. America Bull., vol. 60, no. 12, pp. 1837–1856, 1949.

Strain characteristics determined by study of elastic rebound strain increments of aftershock sequences derived from the instrumental magnitude scale are in close agreement with the creep-recovery characteristics of rocks as measured in the laboratory. The method has been extended to a study of sequences of earthquakes in active seismic regions. For a given sequence a graph of accumulated increments plotted against time represents the actual fault movement during the interval. The method may also be used to determine whether or not a chosen sequence represents movements of a single fault structure.

Studies of the Tonga-Kermadec Islands and South American earthquakes suggest that they originate on great faults, approximately 2,500 and 4,500 km. long respectively, dipping under the continental masses. The transverse dimensions are approximately 900 km. each and both extend to depths of approximately 650 km. It is suggested that oceanic deeps associated with these faults are the surface expression of downwarping of the oceanic blocks while upwarping of the continental blocks has produced the islands of the Tonga-Kermadec region and the Andes. Preliminary examination of other deep-focus sequences associated with oceanic deeps, such as the Aleutian sequence, that from southern Japan to

Kamchatka, several sequences in the East Indies, Central America, and West Indies, suggests that all may be generated on similar great faults.—*M. C. R.*

11736. Kuhn, Werner. Zur Diskussion über die Homogenität des Erdinnern [On the homogeneity of the earth's interior]: Die Naturwissenschaften, vol. 33, no. 10, pp. 311–312, 1946.

The discontinuity at the depth of 2,900 kilometers is believed to be the result of a gradual decrease in viscosity which prevents the transmission of transverse waves and greatly damps longitudinal waves. The core is stated to consist of ten percent iron in which is dissolved 90 percent hydrogen under pressure of 2×10^6 atmospheres at a temperature of 5,000° C.—*S. T. V.*

11737. Bath, Markus. Some long period variations of microseismic activity: Geofis. Pura e Appl., vol. 12, pp. 121–126, 1948.

Seismograms of the Uppsala Observatory for 1907–47 were investigated for periodicity of microseism disturbances. An eleven-year period, negatively correlated to the sunspot frequency, was established. This is probably connected with the displacement of the dominant cyclonic tracks as in years of maximum solar activity the cyclones move on more southerly lines than in years of minimum solar activity. Slight indications were also found for a 28 month period.

No correlation exists between sunspots and microseisms for individual months, as the meridional displacement of dominant cyclonic tracks is slow and does not react to short-time variations of solar activity.—*S. T. V.*

11738. Leet, L. D. Discussion of tripartite microseismic measurements: Seismol. Soc. America Bull., vol. 39, no. 4, pp. 249–255, 1949.

The accuracy of the determinations of the bearing of microseismic waves by tripartite station measurements will be seriously affected if waves approach from more than one direction. In many, if not all, storms the evidence suggests such occurrences. Specific cases are discussed of waves of the same and of different periods crossing a tripartite network and it is shown that routine averaging of intervals from time marks to the nearest crest or trough may lead to serious errors if the pattern and character are not considered. Velocity determinations also may be in error when they are based solely on horizontal component records which do not permit distinguishing between Rayleigh and *Q* waves.—*M. C. R.*

11739. Leet, L. D. Microseisms: Sci. Am., vol. 180, no. 2, pp. 42–45, 1949.

Research on the origin of microseisms and their uses in the prediction of storms is traced through the works of E. Wiechert, B. Gutenberg, F. Kishinouye, H. Krug, J. Ramirez, M. Gilmore, and Leet. Microseisms produce a unique pattern of wave motion at each station, indicating that they come from a multiplicity of sources and represent groups of waves crisscrossing the earth's crust from several directions. Although the tripartite method has suggested deep barometric lows over the oceans as the origin of microseisms, the method is not infallible if the direction of propagation of a wave is calculated regardless of whether it is a pure wave of a known type or the product of some complicated combination of waves. The use of a pure Rayleigh wave isolated in microseisms as a guide to direction, as done by Leet in studying the cyclonic storm of November 14, 1945, does not in itself possess the desired accuracy but in combination with the tripartite method it may make possible a determination of the direction of travel of an isolated pure microseismic wave.—*V. S.*

11740. Morelli, Carlo, and d'Henry, G. Sulle cause dei microsismi [Causes of microseisms]: Annali Geofis. vol. 2, no. 2, pp. 281–289, 1949.

From a study of microseisms registered at the Geophysical Observatory of Trieste as related to 43 meterological conditions from the records of the Swiss Meteorological Zentralanstalt for 1946–48, it is concluded that any atmospheric disturbance of a periodic character and sufficient intensity can cause microseisms. This effect remains local except in an atmospheric disturbance over the ocean, when microseisms are always produced, even if the cold front or the lines of occlusion are over the continent. When the center of the cyclone is over the continent and the front over the ocean no microseismic disturbance spreading over any considerable area was discovered. Increases in the area covered by the cyclone increases the intensity of the microseisms. If the cyclone moves so that its center is displaced from the continent toward the ocean the microseisms increase in amplitude. Certain differences are recognized between the microseisms resulting from an atmospheric disturbance over the Atlantic Ocean and one over the Mediterranean Sea.—*S. T. V.*

11741. Zanon, F. S. Microsismi meteorici [Microseisms produced by meteorological factors]: Geofis. Pura e Appl., vol. 12, pp. 200–209, 1948.

The correlation of microseisms observed during 1933–34 on the Vicentini microseismograph at the Venice Seismological Observatory with cyclones observed over the north Atlantic Ocean, near Greenland and the shores of the Scandinavian peninsula was investigated. A regularity is noted in the variation of the period of microseismic waves from six seconds to nine seconds with a simultaneous increase in amplitude, parallel to the decrease of the distance of the cyclone from Venice. Conversely when the cyclone diminishes in intensity or begins to move away, the amplitude of the waves decreases and the period gradually changes from nine seconds to six.

Impulses caused by periodic variation of the barometric pressure in the cyclone over the ocean produce impulses in the granitic layer of the crust which travel great distances. For regions where the natural oscillations of the upper layer have a period of about 6–9 seconds, these impulses are manifested as forced vibrations of great intensity. Thus microseisms caused by cyclones over the northern Atlantic Ocean are recorded in Venice in spite of the separation by the Swiss Alps.—*S. T. V.*

11742. Wanner, E. Erdbebengeräushe [Seismic noise]: Geofis. Pura e Appl., vol. 12, pp. 127–129, 1948.

Several aftershocks of the earthquake of January 27, 1946 in Valais, Switzerland, accompanied by pronounced acoustic phenomena, were observed with a portable seismograph near the epicenter. The aftershocks can be classified into two types, one beginning with a sharp impulse and accompanied by a noise as from an explosion, the other characterized by weak forerunners and a sound like an approaching car.—*S. T. V.*

11743. Bachinskii, N. M. Antiseismic measures in the monumental architecture of Central Asia [in Russian]: 48 pp., Moscow, Akad. Nauk SSSR, 1949.

Details of the architectural engineering of buildings, several centuries old, in Central Asia are described. Many are erected on foundations in the shape of inverted pyramids on which is spread a clay mat. Joints of rush and clay which separate the buildings into smaller units, are wide at the base and taper toward the top. Beams supporting floors protrude beyond the walls allowing for variation of distance between walls. On the whole, the buildings have resisted the effects of earthquakes very well.—*S. T. V.*

11744. Medvedev, S. V. Measures against destructive effects of violent earthquakes [in Russian]: Akad. Nauk SSSR, Vestnik no. 8, pp. 28–33, 1949.

Severe damage often caused by earthquakes prompted the Academy of Sciences of U. S. S. R. to appoint a number of geophysical committees to study the necessary protective measures. The whole area was divided into three zones in accordance with the frequency of earthquakes and their intensity. In studying this problem, it was found necessary to distinguish between the regional seismicity and local conditions increasing or decreasing the seismic danger. The surface layer, upon which the building foundations are laid, has considerable importance, seismic danger being lowest for crystalline formations and highest for quicksand and peat bogs, with many intermediate forms. The height of the water table also influences the seismic effects.

Another approach to the problem under consideration is the determination of the types of structures which embody the greatest resistance to seismic shocks. Instruments are to be developed to indicate the magnification of the ground amplitudes in different stories and in different types of buildings. For example, it has been observed that square or rectangular structures are more resistant than those of L-shape or T-shape. Buildings of one height seem to be more resistant than those with towers.

A number of accelerometers, frequency indicators, velocity indicators, and analyzers have been constructed for studying the behavior of different buildings and different portions of buildings during earthquakes. There seems to be no doubt that structures of steel and of reinforced concrete are the strongest. The necessity of reinforcing brickwork against shearing stresses is also evident. The influence of separating joints in large buildings is also often favorable.—*S. T. V.*

ELECTRICITY

11745. Rooney, W. J. Earth-current results at Tucson Magnetic Observatory, 1932–42, Carnegie Inst. Washington, Dept. Terrestrial Magnetism Researches, vol. 9, 309 pp., 1949.

Earth-current potentials on two lines 60 and 90 km. long were recorded for approximately eleven and one-half years, a full sunspot cycle, thus making possible establishment of correlation with associated phenomena. Tables give the annual means in sunspot number and in range of earth-current potential gradient; Fourier analysis of monthly means of earth-current gradients; diurnal variation in earth-current potential gradient referred to various means; earth-current potential gradient, hourly values for the whole period of observations. The results of the observations are discussed as to the importance of the variations, their relation to solar activity, seasonal changes, comparison with magnetic records, and lunar diurnal variations.—*S. T. V.*

11746. Takubo, Jitsutaro. Versuche über die Dielektrizitätskonstanten einiger Mineralien und über das dielektrische Verhalten derselben bei Erhitzung [Experiments on the dielectric constants of some minerals and on the variation of their dielectric properties due to heating]: Kyoto Imp. Univ. Coll. Sci. Mem., vol. 16, no. 2, pp. 95–154, 1941.

The dielectric constants of minerals and a few liquids were experimentally determined, using the method of Drude with undamped oscillations produced by a triode tube. A circuit was formed with a condenser inserted in it, the dielectric plate of the condenser being made of the mineral investigated, and conditions of resonance in the circuit observed. The wave length applied was 101.43 cm. and the temperature was first kept at 25° C. For crystalline, anisotropic substances the relation used was: $e=e_1 \cos^2 m+e_2 \cos^2 n+e_3 \cos^2 l$ where e_1, e_2, and e_3 are the dielectric constants measured in the direction of the principal axes, and m, n, l are the angles of inclination of the direction chosen in the experiment.

Sixty-two minerals were investigated, including sulfur, sphalerite, fluorspar, quartz, calcite, aragonite, and leucite. Tables of the results obtained and numerous graphs are included in the paper, which also contains a detailed description of the experimental set-up. When the temperature was varied a sharp change was observed with sulfur at the point of its transformation from rhombic to monoclinic, sphalerite showed a discontinuity at 220° C., probably caused by the appearance of cracks, and aragonite had an abrupt decrease of the dielectric constant at 473° C., perhaps because of its transformation into calcite.—*S. T. V.*

RADIOACTIVITY

11747. Curtiss, L. F. Measurements of radioactivity, U. S. Nat. Bur. Standards, Circ. 476, 84 pp., 1949.

The physical nature of natural and artificial radioactivity, and the detection and measurement of radioactive radiations by their action on photographic emulsions, on certain crystals, or by the ionization of gases are described. Radioactive standards and units used in radioactive measurements are also discussed. A special chapter is devoted to radioactivity in geology, including age determinations by the lead uranium ratio and by helium content, the importance of pleochroic halos in measurements of geologic time, and methods of determination of radium and thorium content in rocks.—*S. T. V.*

11748. Curtiss, L. F., Evans, R. D., Johnson, Warren, and Seaborg, G. T. Units of radioactivity: Science, vol. 110, no. 2864, p. 542, 1949.

A joint committee of the Divisions of Chemistry and Chemical Technology and Mathematical and Physical Sciences of the National Research Council has recommended the following definitions to the Commission on Standards, Units, and Constants of Radioactivity of the International Unions of Chemistry and Physics. Curie, that quantity of any radioactive species undergoing exactly 3.700×10^{10} disintegrations per second. Rutherford, that quantity of any radioactive species undergoing 10^6 disintegrations per second. R. h. m., roentgen per hour at one meter (recommended for quantitative comparison of radioactive sources emitting gamma rays for which disintegration rates cannot be determined).—*M. C. R.*

11749. Curtiss, L. F. The Geiger-Müller counter, U. S. Nat. Bur. Standards, Circ. 490, 25 pp., 1950.

Information regarding the nature, construction, and use of Geiger-Müller counters is summarized. A bibliography is included.—*M. C. R.*

11750. Hine, G. J. Sensitivity of gamma-ray counters: Science, vol. 110, no. 2858, pp. 380–382, 1949.

Methods for increasing counter sensitivity are outlined because even the counters made from high atomic material detect only 0.7 to 2 percent of gamma rays with energies between 0.5 and 3.0 m. e. v. when these penetrate the counter walls perpendicularly. Organic and inorganic crystals have come into use recently as scintillation counters, the gamma rays absorbed in them producing light flashes amplified by photomultiplier tubes. Among these counters, calcium tungstate crystals show a very great gamma-ray sensitivity because of their high density and high atomic-weight components. Sensitivities of 24, 38, and 36 percent were obtained respectively for Co^{60}, Ra, and I^{131} gamma rays with very polished, clear cystals ⅛ x ½ inch and ⅛ inch thick. The technique used is described. Increased sensitivities can also be obtained by using Geiger-Müller counters end up. Sensitivities of about 2 percent for I^{131} and 4 percent for Co^{60} and Ra have been observed with commercial end-window tubes.—*V. S.*

11751. Kimura, Kiichi and Uemura, Yoshiaki. A counting instrument with linear amplifier: Kyoto Imp. Univ. Coll. Sci. Mem. sec. A., vol. 23, no. 1, pp. 1–6, 1940.

An instrument has been constructed following the original suggestion of Grienacher and Wynn-Williams and Wards but with the following modifications: the counting chamber is a parallel plate condenser having a collecting electrode 2 cm. in diameter, and the inner electrode is surrounded by a circular guard ring, this shielding being found indispensable for accurate measurements. The linear amplifier employs resistance-capacity coupling. Its most critical detail is the first stage, equipped with a RCA–6J7 tube. A grid leak resistance of 10^9 ohms was used, at the first tube, with a grid voltage of about -0.8 volts. A detailed description of the instrument and a wiring scheme are given.—*S. T. V.*

11752. Jurney, E. T. and Maienschein, Fred. The gamma-ray counting efficiency for a lead-cathode G–M counter: Rev. Sci. Instruments, vol. 20, no. 12, pp. 932–934, 1949.

The relative gamma-ray counting efficiency for a Geiger Müller counter with a lead cathode has been experimentally determined as a smooth increase with increasing energy in the range 0.17 to 2.76 m. e. v.—*M. C. R.*

11753. Poole, J. H. J., Delaney, C. F. G., and McCormick, R. C. The possible existence of a fourth natural radioactive series: Royal Dublin Soc. Sci. Proc., vol. 25, new series, no. 9, pp. 101–116, 1949.

Unexplained pleochroic halos in Ytterby mica suggested the possible presence of the neptunium $(4n+1)$ radioactive series. Experiments using both the nuclear plate technique and an ionization-chamber alpha-ray counter in general proved the neptunium series does not exist in mica, at least in amounts comparable with those of the uranium and thorium series.—*M. C. R.*

11754. Picciotto, Edgard. Etude de la radioactivité du samarium par la methode photographique [Study of the radioactivity of samarium by the photographic method]: Acad. Sci. Paris Comptes Rendus, vol. 229, no. 2, pp. 117–119, 1949.

A knowledge of the half life of samarium combined with an isotopic study of samarium and neodimium can serve as a basis of a method of determining the absolute age of rocks. An investigation by the photographic method of the number of particle groups and of the period of $(SO_4)_3\,Sm_2.8H_2O$ showed that Sm emits only one group of alpha particles of 7μ in the Ilford B and C emulsions, and that based on a tentative count of alpha rays of 133 ± 6 per gram per second, the half life of Sm is $(6.7\pm0.4)\ 10^{11}$ years. This is in good agreement with Libby's figure of $(6.3\pm0.5)\ 10^{11}$ years.—*V. S.*

11755. Holland, H. D. and Kulp, J. L. Alpha activity of rocks and sediments by scintillation counting [abstract]: Geol. Soc. America Bull., vol. 60, no. 12, pt. 2, p. 1896, 1949.

Scintillations produced on a zinc sulfide screen by alpha particles may be used as a quantitative method of determining alpha activity. A scintillation counter with a C–1732 RCA photomultiplier tube may be adapted for low-activity samples by means of a truncated lucite cone. The counter is being used to study the alpha activity and age determination of rocks and ocean-bottom sediments.—*M. C. R.*

11756. Kimura, Kiichi. Study on radioactivity of hokutolite in Taiwan by means of a counter with linear amplifier: Kyoto Imp. Univ. Coll. Sci. Mem., sec. A, vol. 23, no. 1, pp. 7–17, 1940.

Measurements of alpha activity were made on some twenty different specimens of hokutolite, using a counting system with linear amplifier, which permits detection of individual alpha particles in the presence of beta and gamma rays. The number of alpha particles from the surface of a sample was measured with different thicknesses of aluminum foil inserted between the ionization chamber and the sample, with activity of U_3O_8 used as a standard. The alpha activity of hokutolite was found chiefly due to polonium and radium with radium products. The activity of the natural surface of a young mineral is far stronger than that of the interior. The activity of the polonium was found to be $3.8 \times 10^{-12} g$ and that of the radium $1.3 \times 10^{-9} g$ with its products being in equilibrium. The Po content is more than 15 times that of direct derivatives of Ra.—*S. T. V.*

11757. Thommeret, J. ·Evaluation de la teneur en uranium des rayonnements nucleaires [Determination of the uranium content in radioactive substances]: Jour. physique et le radium, vol. 10. nos. 7–8–9, pp. 249–252, 1949.

A procedure is suggested which gives approximate but sufficiently accurate determinations of the radium content of minerals by two measurements with an ordinary Geiger-Müller counter. This method is based on the fact that uranium produces only beta rays while radium and its derivatives produce both beta and gamma rays, and in many minerals the ratio of beta and gamma radiation is a constant capable of being accurately determined.

Details of the procedure and precautions for eliminating errors in measurement are given. The method is accurate within 5–10 percent. For U content greater than 4 percent it is necessary to dilute the sample and for U content less than 0.1 percent the method is ineffective. It is also not applicable to minerals containing thorium.—*S. T. V.*

11758. Kulp, J. L. and Carr, D. R. Surface area of deep sea sediments [abstract]; Geol. Soc. America Bull., vol. 60, no. 12, pt. 2, p. 1902, 1949

Age determination of unconsolidated ocean sediments by the radioactive in-equilibrium method depends on the preferential adsorption of ionium and radium ions on the surface of precipitating particles. As the adsorptive properties depend on the chemical nature and the surface area of the particles, for a constant mineral type the number of ions adsorbed will be proportional to the surface area. The surface areas of about 50 representative core samples obtained by the Emmett-Brunaver gas adsorption method range from 2 sq. m./gm. for fine red silt to 40 sq. m./gm. for very fine inorganic calcium carbonate. Deep-water red clay has a surface area of about 25 sq. m./gm. and the more common green clay from shallower water ranges between 10 and 15 sq. m./gm.—*M. C. R.*

11759. Ahrens, Louis. Measuring geologic time by the strontium method: Geol. Soc. America Bull., vol. 60, no. 2, pp. 217–266, 1949.

Age determinations by the strontium method can be made on most potassium and cesium minerals, which contain nearly all existing radiogenic lead. Lepidolite has the highest proportion of such strontium, but high concentrations are also frequently found in amazonite, poleucite, hydrothermal pegmatite microcline, zinnwaldite, and some lithium-rich muscovites. A reasonably reliable age can usually be determined from lepidolite without an isotope analysis, but with all other minerals such analyses are necessary. In all, 32 strontium age determinations are known, 30 of which have been made by a spectrochemical method which is described. Included are determinations of $2,100\times10^6$ years for some pegmatites from southeastern Manitoba, believed to be greater than any other region on which sufficient data are available. The procedure is rapid but lacks precision, and age reproducibility is only within 10–15 percent. Where comparisons are possible, strontium ages agree reasonably well with lead and helium (magnetite) determinations. The strontium method is probably superior to the lead and helium methods for dating very ancient rocks. It is unsuitable for younger rocks and it is unlikely that ages of less than 50×10^6 years can be measured successfully.—*M. C. R.*

11760. Hurley, P. M. Radioactivity and time: Sci. Am., vol. 181, no. 2, pp. 48–51, 1949.

The following radioactive methods of measuring geologic time are outlined and illustrated: the lead-uranium ratio, magnetite-helium ratio, strontium-rubidium ratio, thorium-uranium ratio, suitable for determinations within the Pleistocene period; C^{14} content in wood, sea shells, and other materials for measurements within shorter periods; and possible future use of K^{40}, which may decay to Ca^{40} or to A^{40}. The present results of measurements of rock ages are summarized in a table of the history of the earth.—*V. S.*

11761. Marble, J. P. Accuracy of the lead method for the absolute measurement of geologic ages [abstract]: Geol. Soc. America Bull., vol. 60, no. 12, pt. 2, p. 1907, 1949.

Basic factors in the method are reviewed.—*M. C. R.*

11762. Morelli, Carlo. L'età della terra [The age of the earth]: Annali Geofis., vol. 2, no. 3, pp. 417–435, 1949.

Attempts to determine the age of the earth from astronomical, geophysical, and biological evidence are reviewed. An age of 3.3 billion years for the earth has been determined from radioactivity measurements. The age of the solar system is not less than 10^{10} years.—*S. T. V.*

11763. Hurley, P. M. Progress report on age measurements. Appendix A to the report of the special committee on the geophysical and geological study of continents, 1948–49: Am. Geophys. Union Trans., vol. 31, no. 1, pp. 142–144, 1950.

A correlation of age determinations with direction of structural trends in pre-Cambrian rocks shows an encouraging degree of relationship. Eight groups of age measurement in millions of years are reported as follows: eastward trending structures in Manitoba, Ontario, and Quebec, 1,950 to 2,400; northward trending structures in Northwest Territories, Manitoba, and South Dakota, 1,300 to 1,400; eastward and various trends in Michigan and southern Ontario, 1,100 to 1,600; northeastward trending structures and so-called Algoman granite in southern Ontario and Quebec, 800 to 1,050; northwestward-trending structure in Llano County, Tex., 1,040 to 1,050; northeastward trends from Vermilion Range in Minnesota through Colorado and New Mexico, 750 to 900; northeastward-trending structures in southern Appalachian pre-Cambrian exposures, 600 to 800; and northeastward-trending and structures of various trends in New Jersey highlands and Adirondacks, 450 to 725 with one measurement of 1,500.—*M. C. R.*

11764. Davis, G. L. and Hess, H. H. Radium content of ultramafic igneous rocks: II. Geological and chemical implications: Am. Jour. Sci., vol. 247, no. 12, pp. 856–882, 1949.

Recently published measurements of the radium content of some ultramafic igneous rocks and of the constituent minerals indicate radium and uranium decrease with increasing mafic character. The hypothesis is suggested that virtually the entire radium content is contained in a small volume of late stage minerals, particularly kämmererite, talc, and tremolite, or possibly entirely in kämmererite. —*M. C. R.*

11765. Hurley, P. M. Distribution of radioactivity in granites and possible relation to helium age measurements: Geol. Soc. America Bull., vol. 61, no. 1, pp. 1–8, 1950.

A much higher rate of alpha-particle emission than that expected from the known total uranium and thorium content has been found for granulated samples of felsic rocks. Presence of radioactive elements as secondary mineral coatings on the surfaces of the granules is suggested by abnormally large residual ranges of the alpha particles. Removal of most of the alpha-particle activity by dilute hydrochloric acid leaves activity corresponding to the low uranium and thorium content found in sandstones and arkoses in which the mineral grains have been rounded and cleaned by attrition. Granite samples from considerable depth show a lower proportion of surface activity than those from the zone of surface-water saturation. A relationship apparently exists between losses of activity by acid treatment and the degree of retentivity of helium. From determination of the helium age ratio before and after acid treatment it is inferred that the helium content of essential rock minerals is commensurate with their age and with the quantity of radioelements uniformly distributed within them, and not removable by acid. The low ratio of helium to radioactivity for the rock as a whole may be due to loss of helium from highly radioactive areas that are easily affected by acid (and inferentially by ground waters) or to supergene enrichment of radio-elements late in the history of the rock.—*M. C. R.*

11766. Slack, H. A. Radioactivity measurements in the Kirkland Lake area, northern Ontario: Am. Geophys. Union Trans., vol. 30, no. 6, pp. 867–874, 1949.

Measurements of the alpha-particle emission from 316 samples from the Round Lake batholith show a regular increase in radioactivity from south to north. As the batholith is believed to plunge northward, this suggests the top of the batholith is more radioactive than the lower portions. Comparison with average activities for the Cheddar, Bourlamaque, and Elzevir batholiths show all three have high activity near the rims and lower values toward the centers. This has been interpreted as a migration of the accessory radioactive minerals to the top.

Average values of radioactivity of the acid rocks here are low, that of 74 samples being 1.48 cal./gm. per million years compared with the world-wide average of 5.6 cal./gm. per million years. This is in keeping with the observation that pre-Cambrian granites are less radioactive than younger ones. If high radioactivity is due to rise of radioactive elements during emplacement, deeper parts of the crust may contain less radioactive elements and the average values from surface measurements may be too high to represent the average radioactivity of the crust.

On the basis of crustal constitution as determined seismologically and the average radioactivity here determined it is calculated that 40 percent of the total heat flow from the interior of the earth may be accounted for by the radioactivity of the rocks of the top 36 km. Erosion has removed the more highly radioactive material from the surface and deposited it along the continental edges. These deposits may have determined the location and their relatively greater heat may have assisted in the formation of marginal mountain chains.—*M. C. R.*

GEOTHERMAL STUDIES

11767. Benfield, A. E. The temperature in an accreting earth: Am. Geophys. Union Trans., vol. 31, no. 1, pp. 53–57, 1950.

The possibility is examined that the earth, if it formed by accretion, did so as a molten body rather than as a solid. It is shown that the age of the earth need not be supposed to be seven billion years in order for its surface to have been molten. The outer part of the earth could have been in a molten condition as the process of formation by accretion approached its end. The effect of pressure alone seems to have been inadequate to cause melting in the interior, but the estimate of rise in temperature by compression rests on approximate calculations.—*M. C. R.*

TECTONOPHYSICS

11768. Jardetzky, Wietcheslaw. On the rotation of the earth during its evolution: Am. Geophys. Union Trans., vol. 30, no. 6, pp. 797–817, 1949.

Several models are necessary for the study of the rotation of the earth during its whole evolution. In the liquid state the earth was in a state of zonal rotation similar to that now observed on the Sun, Jupiter, and Saturn. This was maintained after the formation of the crust. Many types of currents are possible in the earth's interior. Those along the parallels, whose angular velocities increase under the crust from the poles to the equator, can explain the spreading of continents and mountain building but others have little influence. The regular zonal currents in the interior of an earth with a thin crust result in a certain mean rotation of the crust around the same axis. Asymmetry of the distribution of masses in the crust and the tendency of the earth to adopt a state of equilibrium corresponding to the position of the instantaneous axis of rotation may have caused a slow secular displacement of the crust in space progressive throughout geological time. The migration of the poles seems to be explained by a theory of Milankovitch relating the displacement of the poles to the direction of the gradient of the moment of inertia.—*M. C. R.*

11769. Wasiutynski, Jeremi. Dzieje powerzchni ziemi w świetle dynamiki planet [The surface history of the earth in the light of planetary dynamics]: Wiadomości muzeum ziemi, Tom 4, pp. 21–32, 1948.

The article is a brief summary of the author's book "Studies in hydrodynamics and structure of stars and planet" (Astrophysica Norvegica, vol. 4, 1946) concerning the orogenic currents believed to be taking place not only in the earth, but also in the interior of the sun, the moon, and other planets. The existence of a vortical inner motion in the mass of the sun is postulated from the presence of a layer of almost pure hydrogen covering the sun's surface to a thickness of $\frac{1}{18}$ of the radius of the sun. This hydrogen is produced by physico-chemical processes in the sun's interior and is carried to the surface by convection and diffusion. Most of the stars also have such hydrogen covers. The phenomena observed when a nova appears are explained as a disturbance of chemical equilibrium in such a star. Vortical cells which in the opinion of many geologists covered the surface of the earth at the beginning of its cooling are cited as an example of parallelism in evolution of different planets. These cells or fields, produced by vortex motion of the still plastic crust formed a pattern of boundary lines very similar to "canals" of Mars. The present surface of this planet must resemble that of the earth during the Proterozoic and Paleozoic eras.—*S. T. V.*

11770. Escher, B. G. Origin of the asymmetrical shape of the earth's surface and its consequences upon volcanism on earth and moon: Geol. Soc. America Bull., vol. 60, no. 2, pp. 352–362, 1949.

This is the presidential address before the International Association of Vulcanology, 1948. The hypothesis is offered that after the moon was torn from the crust, the rest of the crust moved toward the wound, and the movement was braked when a ring was formed. Beneath the moving sialic floes was viscous magma already partly solidified and beneath that less viscous sial. The latter, being less dense, came to the surface and formed a thin cover behind the floes. The following problems are explained by this hypothesis: the asymmetrical shape of the face of the earth; the origin of continents and oceans; the thin sialic layer under the Atlantic and Indian Oceans; the formation of lunar cirques; the much stronger vulcanism on the moon than on the earth.—*M. C. R.*

11771. Schmidt, E. R. A föld felszinenek geomechanikája [Geomechanics of the earth's crust]: Földtani Közlöny, vol. 78, no. 1–12, pp. 94–102, 1948.

The structure of the earth's crust, formation of its oceans and continents are considered to be the result of one and the same geomechanical process. Mechanical forces caused by rotation of the earth are believed the most important factors in the earth's history. These forces cause meridional stresses and ruptures. Displacement of the terrestrial axis of rotation produced diagonal slip lines, as was suggested by B. Rudemann. Further action of the earth's rotation caused the bursting of the crust along the equator, where the centrifugal force is the greatest, an explanation advanced by L. Kobers in his theory of orogenic rings. At this phase in its history the earth ceased to be a mechanical unit and must henceforth be considered as a system of moving bodies acting one upon another and producing deformations along the lines of contact of these bodies owing to pressure forces. The twisting of the southern continents with respect to the northern hemisphere may be explained as a result of the Coriolis force caused by subsequent changes in the position of the earth's axis.—*S. T. V.*

11772. Roubault, Marcel. La génèse des montagnes [The origin of mountains]: 243 pp., Paris, Presse Universitaires de France, 1949.

The formation of mountains and the origin of relief on the earth are reviewed. Among the topics discussed are: internal structure of the globe and the importance of seismological evidence in its study; the shape of the earth, and the gravitational method of its investigation; isostasy; variation of pressure and density throughout the earth; thermal state of the earth; radioactivity as one of the sources of heat; distribution of mountains; principal types of folds and other tectonic forms; causes of the formation of mountains; and experimental studies of the deformation of rocks.—*S. T. V.*

11773. Rutten, L. M. R. Frequency and periodicity of orogenetic movements: Geol. Soc. America Bull., vol. 60, no. 11, pp. 1755–1770, 1949.

Critical analysis of Stille's theory of short, worldwide, and synchronous orogenetic phases alternating with long anorogenetic periods suggests that facts are not in accordance with this theory. A correlation in time for orogenetic movements in widely separated regions of the earth is often found but is of a very general character and no correlation of sharply limited orogenetic phases can be established over wide areas. Orogenetic activity is not confined to a single short burst but is composed of several active phases of mountain building during a rather long period of general tectonic unrest.—*M. C. R.*

11774. Oulianoff, Nicolas. Les problemes des tectoniques superposées et les methodes geophysiques [Problems of superposed tectonics and geophysical methods]: Soc. vaudoise sci. nat. Bull., vol. 64, no. 273, pp. 213–222, 1949.

Geophysical investigations, seismic and gravitational and sometimes electrical and magnetic techniques, preferably in combination are suggested as means of determining the major alinements of ancient structures, particularly those which have been distorted by later orogeny.—*M. C. R.*

REGIONAL STUDIES

11775. Woollard, G. P., Chairman. Report of the special committee on the geophysical and geological study of continents, 1948–49: Am. Geophys. Union Trans., vol. 31, no. 1, pp. 132–142, 1950.

The following geophysical activities having direct bearing on the study of continents are reviewed: critical evaluation of the world's primary gravity base station values by Hirvonen and Morelli, and check with improved gravity meter by Woollard involving one globe-girdling loop and four trans-oceanic loops; relative gravity measurements at Washington and Teddington; regional gravity mapping in North and South America; airborne and ground magnetic surveys; studies of crustal structure by seismic methods; and radioactive and thermal measurements.—*M. C. R.*

11776. Wilson, J. Tuzo. Recent applications of geophysical methods to the study of the Canadian Shield: Am. Geophys. Union Trans., vol. 30, no. 1, pp. 101–114, 1950.

Geophysical investigations of the Canadian Shield are reviewed. They include gravimeter surveys, airborne magnetometer surveys, radioactive age determinations, the mathematical approach to theories of earth mechanism, seismic measurements of crustal layers, geothermal measurements, studies of the distribution of radioactivity, measurements of the temperature and pressure of deposition of minerals, and variation of isotopic content of elements. The paper is devoted primarily to methods, but Wilson suggests that present evidence is compatible with the idea that the continent has grown by the accretion of roots of marginal mountain ranges. An extensive bibliography is included.—*M. C. R.*

11777. Reich, H. Geophysikalische Probleme in bayrisch-schwabishen Donau-Raum [Geophysical problems in the Bavarian-Schwäbian Danube basin]: Erdöl u.Kohle, 2d Jahrg., Heft 3, pp. 81–87, 1949.

Magnetic, gravitational, and seismic work in the German forelands of the Alps are summarized. Magnetic anomalies are small throughout the Bavarian-Schwabian plateau and indicate that thick sediments overlie relatively undifferentiated, predominantly granitic crystalline rocks. The gravity pattern is dominated in the south by the negative zone along the Alps and in the north by the positive zone from Würzburg to Karlsruhe. The massifs in the middle belt are isostatically compensated by outlying, smaller, deep-seated masses and thus exert an influence beyond their boundaries. Magmatic concentrations appear to be either small or very deep. Seismic data obtained in 1948 in the Ries area indicate a depth to the upper crystalline surface ranging from 300 meters in the north to 600–700 meters in the south and a Tertiary thickness of from less than 100 to 300 meters. Velocities average 1,800 m./sec. in the Miocene, 2,300 to 2,800 m./sec. in the Mesozoic, and 5,000 to 5,500 m./sec. in crystalline rocks.—*V. S.*

11778. Zwerger, Rudolf von. Der tiefere Untergrund des westlichen Peribaltikums—Beitrag zur Deutung der regionalen storgebiete des Schwere und des Erdmagnetismus [Deeper underground structure of the western Peribaltic—A contribution to the interpretation of the regional gravitational and geomagnetic anomalies]: Berlin, Geol. Landesanstalt, neue Folge, Heft 210, 74 pp., 1948.

Results of the gravitational and magnetic surveys of the Peribaltic are reviewed and a tentative interpretation of the geological significance of the anomalies found in this area is proposed. The Peribaltic is defined as the belt around the crystalline Baltic Shield characterized everywhere by positive magnetic anomalies caused by the insignificant depth of the overburden. The western Peribaltic includes northwestern Germany from 8° to 15° E. longitude.

In the region north of the Elbe positive gravitational anomalies coincide with the magnetic maxima of the Pritzwalk massif and of the main ridge of Mecklenburg. The entire region of positive anomalies is considered to be one body, the east Elbian massif. Transverse dislocations of this massif, conspicuous in the geophysical picture, were produced in the late Mesozoic and Tertiary periods, and are associated with numerous ore deposits. Between this massif and the Lusatian rise is a broad depression which according to gravitational data becomes much narrower southwest of Berlin.

In the east Elbian massif the region around Prigutiz is characterized by thick Tertiary formations which were observed in seismic investigations and confirmed by exploratory drilling. The northwestern edge of this massif shows a decrease of salt deposits, making improbable the presence of any salt domes.

Along the Pomeranian shore and on the island of Rügen gravitational anomalies rapidly increase, suggesting a tectonic relationship with the islands of Fyn and Jutland where gravitational maxima have been discovered.

The Rhenish zone, which is marked by subsidence, is a region favorable for oil accumulation and search for geological structures associated with oil deposits is suggested. Three maps and eleven diagrams illustrate the text.—*S. T. V.*

11779. Geologisches Landesamt. Geotektonische Karte von Nordwest-Deutschland [Geotectonic map of northwestern Germany], scale 1:100,000, 16 sheets, 68 x 70 cm., Hanover, Germany, 1947. Reviewed by Julius Bartels in Jour. Geophys. Research, vol. 54, no. 1, p. 76, 1949.

A geotectonic map has been prepared of an area of about 20,000 square miles in northwestern Germany. It is based on the results of geological and geophysical surveys of 1934–45 and of drilling for oil and iron ore. The upper layers, in general Diluvial and Tertiary, are removed, and in certain areas upper and lower Cretaceous as well. Geophysical data comprise lines of seismic travel-times to a horizontal distance of 4 km. determined by systematic refraction shooting, contours of important subsurface structure derived from bore-hole information and seismic reflection shooting, and results of gravimeter and torsion balance surveys. Special emphasis is placed on the delineation of the numerous salt domes.—*V. S.*

11780. Reich, H. Geophysikalische Karte von Nordwest-Deutschland [Geophysical map of northwestern Germany], scale 1:500,000, 3 sheets, 64 x 70 cm., Reichsamt fur Bodenforsch., Abt. Geophysik, Celle, Germany, 1948. Reviewed by Julius Bartels in Jour. Geophys. Research, vol. 54, no. 1, p. 76, 1949.

Data obtained from magnetic, gravimetric, and seismic surveys between 1934–45 covering an area of nearly 30,000 square miles in northwestern Germany are mapped on 3 sheets. Vertical intensities measured with a Schmidt field balance are plotted in isoanomaly lines from −100 to +230 gammas on the magnetic map. Bouguer anomalies with contours 2 mgal. apart ranging from −10 to +50 mgal. are shown on the gravimetric map. The seismic map gives travel times for a 4-kilometer standard distance, drawn in isochrones 0.1 second apart and ranging from 2.0 to less than 1.0 second over the local salt domes.—*V. S.*

11781. Pettersson, Hans. Exploring the bed of the ocean: Nature, vol. 164, no. 4168, pp. 468–470, 1949.

The results of the Swedish deep-sea expedition of 1947 on the schooner Albatross are reported briefly. The records included the continuous bottom profile of 20,000 nautical miles registered by an ultrasonic echograph, more than 400 oscillograms from explosions in depths between 300 and 3,500 fathoms, 200 long cores from depths between 2,000 and more than 4,000 fathoms, 10,000 temperature readings, and 4,000 samples of sea water.

Explosion echoes gave an apparent thickness of 12,000 feet of sediments in the Atlantic in contrast to less than 1,000 feet in the Pacific and Indian Oceans. Two unexpectedly high geothermal gradients, 22 and 26 meters per degree centigrade, were obtained in sediments in the central and western Pacific. Measurements of radium and uranium content in large-volume samples of sea water confirmed earlier results from more limited material.—*M. C. R.*

11782. Tolstoy, Ivan, and Ewing, Maurice. North Atlantic hydrography and the Mid-Atlantic Ridge: Geol. Soc. America Bull., vol. 60, no. 10, pp. 1527–1540, 1949.

The outstanding features of the area are the conspicuously flat plain between Bermuda and the Azores (roughly between 29°–40° N. lat. and 50°–56° W. long.), and a similar plain at the same depth east of the Azores in the northern Canary basin. Small sea mounts which occur throughout the area appear to increase toward the southern limit of these plains. The mid-Atlantic Ridge, at 1,600 fathoms or less, has two strongly contrasting types of topography. The central backbone consists of a series of parallel ridges trending northeastward while the flanks are a succession of smooth shelves between 1,600 and 2,500 fathoms. Interpretations are based largely on data from cruises of the Atlantis.—*M. C. R.*

EXPLORATION GEOPHYSICS

GENERAL

11783. Bailey, F. G. Worldwide exploration progress: Petroleum Engineer, vol. 21, no. 13, pp. B63–66, 1949.

A review of papers on petroleum geology and geophysical exploration presented at the 18th session of the International Geological Congress, August, 1948, London.—*V. S.*

11784. Browne, B. C. Geophysical surveys and their utilization: Nature, vol. 164, no. 4177, pp. 859–860, 1949.

The papers on geophysics presented at the meeting of the British Association for the Advancement of Science at Newcastle in 1949 are outlined.

B. C. Browne reviewed gravity work in the British Isles. Several thousands of gravimeter measurements have been made, and it is now possible to obtain a fairly accurate picture of the trend of Bouguer anomalies over most of the Midlands and southern England. In general, the agreement with known geology is good. L. H. Tarrant described gravity and magnetic exploration for oil over 6,000 square miles between Birmingham, Bath, Hertford, and Dover in southern England. About 25 percent of this region is found to have a considerable thickness of Upper Carboniferous, and the oil and coal potentialities justify further investigation.

J. Satterly reported on geophysical research in Canada. A transcontinental gravity traverse has been recently carried out from Halifax to Vancouver; gravity, aeromagnetic, and radioactive surveys were made in various areas; rockbursts in mines are being used for seismic studies; and polar investigations are progressing.—*V. S.*

11785. Bruckshaw, J. M. Recent advances in geophysical prospecting: Petroleum, vol. 12, no. 1, pp. 3–7, 1949.

Recent advances in gravitational, magnetic, seismic, and electrical prospecting are essentially adaptations of existing methods to new environments, such as applications at sea and in the air, rather than the development of fundamentally new methods or greatly improved instruments. The technique and equipment for use of telluric currents in the investigation of deep-seated basement rocks are outlined.—*V. S.*

11786. Eby, J. B. The progress of science in petroleum exploration: Oil, vol. 8, no. 10, pp. 13–14, 1948.

The development of geophysics in application to oil exploration is sketched briefly through the main phases of progress in gravitational, seismic, and geochemical methods.—*V. S.*

11787. Eckhardt, E. A. Geophysical activity in 1948: Geophysics, vol. 14, no. 4, pp. 477–485, 1949.

The magnitude, character, and geographic distribution of geophysical exploration in the oil and mining industries throughout the world in 1948 are summarized.—*M. C. R.*

11788. Mintrop, Ludger. Wirtschaftliche und wissenschaftliche Bedeutung geophysikalischer Verfabren zur Erforschung von Gebirgschichten und nutzbaren Lagerstätten [Economic and scientific value of geophysical methods in exploration of geologic formations and deposits of minerals]: Berg-u. Hüttenm. Monatsh., vol. 94, no. 8–9, pp. 189–211, 1949.

The development of magnetic, seismic and gravimetric methods of geophysical exploration and their application in various parts of the world are reviewed.

Geophysical methods of exploration can be used to obtain scientific information as is indicated by the use of the gravimeter in studying the form of the geoid, and modern seismographs combined with accurate time measurement in obtaining information on the deeper structure of the earth's crust. Observations of the Helgoland explosion and of the Messina earthquake of December 28, 1908, are cited [*see* Geophys. Abstracts 139, no. 11531].—*S. T. V.*

11789. Trefethen, J. M. Geology for engineers, 620 pp., New York, Van Nostrand Co., 1949.

The fundamentals of geology are outlined for the engineering student. One chapter deals with different methods of geophysical exploration in engineering including such problems as determination of depth, subsurface structure exploration, location and delineation of geological formations, and subsurface water studies.—*S. T. V.*

11790. Yale, M. V. Geophysics as a factor in the oil industry: World Petroleum, vol. 19, no. 11, pp. 50–51, 1948.

The development of geophysics as an aid to oil exploration is sketched briefly, and the work of a geophysical exploration company including composition of crews, qualifications of personnel, and innovations in equipment is described to illustrate current practices.—*V. S.*

11791. Cox, Harris. Geophysical exploration in the Paraguayan Chaco: Petroleum Engineer, vol. 21 no. 5, pp. B11–17 1949.

The conditions of geophysical exploration for oil in the Paraguayan Chaco during 1945–48 are described with reference to climate, terrain, communications, water supply, and labor.—*V. S.*

11792. Cumming, J. L. El petróleo, su origen, geologia y métodos de exploración [Petroleum, its origin, geology, and methods of exploration]: Petroleos Mexicanos, no. 74, pp. 13–31, 1949.

Theories of the origin and geological occurrence of petroleum are reviewed. The gravitational, seismic, and electrical methods of prospecting are described. Gravitational methods have been successfully used in the plains along the Gulf of Mexico and in the northeastern states of Tamaulipas and Tabasco. Both refraction and reflection seismic surveys have been successfully made in several areas. Statistical data on petroleum reserves in Mexico and elsewhere are included.—*S. T. V.*

11793. Greenman, W. G. Petroleum exploration in Arctic Alaska: Petroleum Engineer, vol. 21, no. 13, pp. B7–12, 1949.

The effect of climate, permanently frozen ground, transportation, and labor on the exploration of Naval Petroleum Reserve No. 4 is discussed. Exploration methods have included aerophotographic mapping, aeromagnetic reconnaissance, geologic studies, gravimetric and seismic surveying, and test drilling.—*V. S.*

11794. Dixey, F. Modern methods of mineral exploration: Nature, vol. 164, no. 4161, pp. 171–174, 1949.

A discussion of papers on gravitational, magnetic, seismic, electrical, radioactive and geochemical methods of mineral exploration and on aerial photography, presented at the Fourth Empire Mining and Metallurgical Congress in London and Oxford in July 1949.—*V. S.*

11795. Joubin, F. R. Modern methods of mineral exploration in Canada: Fourth Empire Min. Met. Cong., July, 1949, paper no. C4, 20 pp., 1949.

A section on modern geophysical techniques based on the material in A. A. Brant's article "Some limiting factors and problems of mining geophysics, with particular reference to Canadian conditions" is included. [*See* Geophy. Abstract 137, no. 11135].

In addition statistical data on mineral exploration in Canada and information on governmental organizations engaged in geophysical work are given.—*S. T. V.*

11796. Nel, L. T., Simpson, D. J., and DeVilliers, John. Modern methods of mineral exploration in South Africa. Fourth Empire Min. Met. Cong., paper no. C2, 23 pp., 1949.

Methods of geophysical exploration and their use in South Africa are briefly reviewed. Magnetic surveys have been successfully used in the Witwatersrand gold fields, where the Witwatersrand system which includes the auriferous conglomerates also includes several magnetic shales, and have led to the discovery of another potential gold field in Orange Free State. Magnetic surveys have also been used to delineate coal fields by detecting the presence of lavas as opposed to sediments, in diamond prospecting because boundaries of the kimberlite pipes can be traced owing to the presence of magnetite and ilmenite, and in locating nickel ores, which are magnetic, and chrome ores, which have associated magnetite. Resistivity surveys have been used to locate pyrite deposits developed in schists, the depth of alluvial tin deposits, schist horizons which carry tungsten, and the approximate depth of a vermiculite deposit.—*S. T. V.*

11797. Sullivan, C. J. Mineral exploration in Australia: Fourth Empire Min. Met. Cong., paper no. C3, 25 pp. 1949.

Geophysical surveys carried out in different regions of Australia for gold, copper, zinc, lead are reviewed without giving details of individual projects.—*S. T. V.*

11798. Dessau, G. The Geophysical Section of the Geological Survey of India: Indian Minerals, vol. 2, no. 3, pp. 167–178, 1948.

Activities of the Geophysical Section of the Geological Survey of India during the first three years of its existence are reviewed by the Geophysicist-in-charge. These included construction and adaptation of equipment for geophysical surveying, and the beginning of some surveys of limited scope such as a spontaneous polarization survey for pyrite deposits, electrical resistivity surveys near dam sites and coal deposits, and for underground water.—*S. T. V.*

11799. McCaslin, L. S., Jr. Sun completes base for geophysical operations: Oil and Gas Jour., vol. 48, no. 3, pp. 105, 111, 1949.

The organization and the chief problems of the research laboratories and shops of the new central base for the geophysical operations of the Sun Oil Co., Beaumont, Tex., are described briefly.—*V. S.*

GRAVIMETRIC METHODS

11800. Garcia Rojas, Antonio. Exploraciones gravimétricas de tipo industrial [Gravitational methods used in industrial exploration]: Ciencia, vol. 9, no. 1–3, pp. 51–65, 1948.

The gravitational method of exploration is described and typical examples taken from Mexican practice show the application of this method in the petroleum industry.—*S. T. V.*

11801. Romberg, Frederick. La inspeccion con medidor gravitacional conduce al descubrimento de minerales [Prospecting with gravimeter reveals the presence of minerals]: Bol. Minero, no. 590, pp. 296–302, 1949.

Gravimetric methods of prospecting used in search for oil are contrasted with those used in prospecting for minerals. As an example a gravitational survey of Houston-Thomas prospect, New Mexico is described in detail.—*S. T. V.*

11802. Barbosa Braga, E. Investigações do sub-solo pelos métodos geofisicos [Subsurface exploration by geophysical methods]: Portugal Inst. Geografico e Cadastral Bol., vol. 3, pp. 97–125, 1943.

During a gravitational survey in the Marinha Grande province, 123 stations were occupied using the Eötvös torsion balance. The surveyed area is characterized by an exceptional regularity of subsurface strata forming a slightly inclined plain of considerable extent and uniform composition. This makes possible a comparison of the observed and theoretically computed gradients of gravity at different points in the area. Agreement between these values was close. A gravimetric map of the surveyed region is appended. The second section of the article contains a discussion of the resistivity method of geophysical exploration and a description of the Megger used in these investigations, again referring to conditions in Marinha Grande province. Numerous measuring schemes are discussed and the corresponding examples calculated.—*S. T. V.*

11803. Carreño, Alfonso de la O. Estado actual de la investigacion gravimétrica en la republica Mexico [Present state of gravimetric exploration in Mexico]: Ciencia, vol. 7, no. 7–8, pp. 243–255, 1946.

Gravimetric surveys in Mexico are conducted by the Geographic Institute of the National University, the Exploration Division of Petroleos Mexicanos, and the Division of Geography of the Department of Agriculture. Work began in 1899 with pendulum instruments. In 1910 a Sterneck instrument was obtained and an absolute determination of gravity made at the base station of Tacubaya. Up to the present 77 stations have been occupied. Petroleos Mexicanos has occupied 35,000 stations with a torsion balance and more than 20,000 with a Mott-Smith gravimeter. Gravitational surveys will soon be extended to the

Atlantic coast and the Mexican network tied to the Antilles-Caribbean network.—*S. T. V.*

11804. Brown, Hart. A precision detail gravity survey, Jameson area, Coke County, Tex.: Geophysics, vol. 14, no. 4, pp. 535–542, 1949.

Because conventional gravity surveys had indicated no significant anomaly, an experimental high density gravity survey was made of about 20 square miles surrounding the discovery well at Jameson. A station density of 15 per square mile was used and measurements made with great precision. Maps of observed and residual gravity with contour intervals of 0.1 mgal. show a maximum with axis trending north and small minimum axes surrounding the gravity maximum. The discovery well is about halfway between the maximum and eastern minimum axes. Subsequent drilling of some 36 field wells has provided data for an accurate reef map and it seems evident that the gravity anomalies are primarily due to the replacement of the normal Pennsylvanian shale section by the limestone reef. A reef of the general magnitude of that at Jameson buried about a mile deep could account for most of the observed maximum if the reef has a density of 0.22 gm./cm.^{3} greater than the surrounding medium, but the minima cannot theoretically have been produced by the reef itself or anything below it.

Since completion of this survey, five crew years of surveys seeking reefs by the same technique have been conducted. Evidence indicates that the majority of limestone reefs will not produce the desired anomalies because they are too deeply buried, too broad compared to their thickness, or because the gradation from reef limestone to normal shale covers too wide a band. However, many reefs do produce measurable anomalies, and gravity surveys using closely spaced, high precision data may be a valuable tool in certain areas, especially when combined with otherwise inconclusive geological data.—*M. C. R.*

11805. Garcia Siñeriz, José. Investigación geofisica en Larache [Geophysical exploration in Larache]: Rev. Geofis., vol. 8, no. 29, pp. 1–12, 1949.

An extensive gravimetric survey in search for possible oil accumulating structures was made in 1947 in the region between Larache, Alcazarquivir and the French Morocco border. A total of 380 stations was occupied and 420 gravity determinations were made with a new Nørgaard gravimeter. Profiles were 100 to 200 meters apart. The results are presented as five graphs of the profiles, and a gravimetric map, several geological cross-sections, tables of readings, and computed reductions. Several promising structures were located.—*S. T. V.*

MAGNETIC METHODS

11806. Henderson, R. G., and Zietz, Isidore. The computation of second vertical derivatives of geomagnetic fields: Geophysics, vol. 14, no. 4, pp. 508–516, 1949.

Second vertical derivatives of magnetic fields are often useful in interpreting magnetic anomalies because of their high resolving power and delineating properties, and because they facilitate the continuation of fields towards sources. Formulas which permit their ready computation are developed with the aid of solutions to the Laplace equation in terms of a Fourier-Bessel expansion.

The accuracy of the methods is investigated by comparing the approximate values with those rigorously computed for simple idealized fields. The accuracy of the derivatives is a function of the size of the grid spacing as well as of the accuracy of observations. The effect of the size of grid spacing is illustrated with contoured maps.

Investigation of the relations between second vertical derivative fields and certain types of residual fields shows that they differ by a numerical factor having the dimensions of the reciprocal of length squared.—*R. G. H.*

11807. Henderson, R. G., and Zietz, Isidore. The upward continuation of anomalies in total magnetic intensity fields: Geophysics, vol. 14, no. 4, pp. 517–534, 1949.

The continuation of total magnetic intensity anomalies from data observed on lower levels is effected successfully for contours exhibiting two- and three-dimensional features. Comparisons between observed and computed anomalies are presented in the form of contour maps and profiles. The mathematical formulas necessary for the upward continuation of the field are presented and the numerical evaluation of the resulting surface integrals is described. In general, the success in field extensions depends on the accuracy of observations, the number of points used in computing, the areal extent and the complexity of the anomaly.

Observations at higher levels are concluded to be unnecessary because almost identical results may be obtained by computing and at a much lower cost.—*I. Z.*

11808. Rumbaugh, L. H., and Alldredge, L. R. Airborne equipment for geomagnetic measurements: Am. Geophys. Union Trans., vol. 30, no. 6, pp. 836–848, 1949.

The modified magnetic airborne detector AN/ASQ–3A, associated instrumentation for geophysical exploration, and reduction of data as used by the U. S. Geological Survey, Naval Ordnance Laboratory, Office of Naval Research, and the Naval Petroleum Reserves are reviewed. A modified system capable of recording the entire magnetic vector field rather than field intensity alone, and associated instrumentation to record pitch and roll of the aircraft frame with respect to the vertical and its orientation with respect to true north are reported nearly ready for flight testing.—*M. C. R.*

11809. Oil. Gulf's airborne magnetometer may revolutionize oil exploration: vol. 8, no. 5, pp. 13, 37–38, 1948.

An account is given of the procedures of aeromagnetic exploration, synchronous shoran mapping, the principles of the Gulf airborne magnetometer, and the history of its development.—*V. S.*

11810. Lundberg, Hans, and Wilson, B. T. The airplane dominates in modern exploration methods: Eng. and Min. Jour., vol. 151, no. 2, pp. 106–107, 1950.

The advantages of the airborne magnetometer and a new airborne electromagnetic method in determining geologic structures and discovering minerals in unexplored areas are reviewed and the latter method briefly described. In the electromagnetic surveys, an alternating electromagnetic field is created by a large coil wound around the fuselage of the plane. During flight this electromagnetic field induces in the ground secondary alternating fields which vary in intensity and travelling time depending on the distance to and the conductivity of the ground. The effects of these secondary fields are recorded by a special receiving unit built into the wings. Changes in conductivity produced by ore bodies or structures of lower or higher conductivity cause variations in the secondary field intensities and in the time it takes for a signal to reach the receiver.

This method makes it possible to detect sulfide bodies and major shear zones.—*M. C. R.*

11811. Petroleum. The airborne magnetometer: Vol. 12, no. 12, pp. 316–317, 1949.

Aeromagnetic surveys are outlined briefly with respect to instruments, methods of operations, flight techniques, and interpretation of data.—*V. S.*

11812. Alldredge, L. R. and Dichtel, W. J. Interpretation of Bikini magnetic data: Am Geophys. Union Trans., vol. 30, no. 6, pp. 831–835, 1949.

An interpretation of the magnetic contour map of Bikini resulting from the aeromagnetic survey in 1947 in terms of possible basement structure has been made by use of model techniques. Zero permanent magnetization and uniform susceptibility were assumed, and a model composed of a mixture of foundry clay, ground magnetite, linseed oil, and glycerine was built up, the model scale factor being approximately 1/48640. A uniform field of 345 milligauss with dip angle of +13.5° and declination of 5° E, the present average field, was applied by a 20-foot three dimensional coil system with the model placed in the center, the north-south gradient of less than three gammas per mile being neglected. A magnetic susceptibility of 0.008 used throughout the model work was derived, assuming a 30-mile separation of fringe-peaks, basement material within 7,000 feet of sea level on the basis of seismic evidence, an applied field of 34,000 gamma, and a central negative peak of 700 gamma.

The resulting magnetic anomaly recorded by a miniature magnetometer showed where model and full scale data differed. Suggested changes were made, always keeping the seismic profiles invariant. The final model shows the basement rising to its highest peak, about 5,000 feet below sea level, approximately one mile northeast of Bikini Island and a string of topographic highs around the atoll fringes with major peaks near each island with the one exception of Cherry Island. The original magnetic anomaly map, magnetic contours resulting from the final model, and a basement relief map are shown.—*M. C. R.*

11813. Balsley, J. R., James, H. L., and Wier, K. L. Aeromagnetic survey of parts of Baraga, Iron, and Houghton Counties, Michigan, with preliminary geologic interpretation: U. S. Geol. Survey Geophys. Inv. prelim. map, 1949.

The total magnetic intensity of an 800 square mile area in the central part of the northern peninsula of Michigan is shown by a series of 45 north-south magnetic profiles obtained on traverses flown about 500 feet above the ground. The magnetic pattern consists of linear anomalies trending essentially east, predominantly positive in the northern area where they are probably caused by Keeweenawan "traps", and in the southern area where they are related to greenstones and magnetic slates. In the central area negative anomalies are caused by diabase dikes with inverse remanent magnetization and very strong positive anomalies are associated with anticlines of a magnetic "slate".—*M. C. R.*

11814. Bourret, Weston. Aeromagnetic survey of the Allard Lake district, Quebec: Econ. Geology, vol. 44, no. 8, pp. 732–740, 1949.

An airborne magnetometer survey of a large anorthosite body in Saguenay County, Quebec containing ilmenite-hematite deposits was undertaken to determine the regional limits of ilmenite-hematite mineralization and to prospect for additional deposits. Over 4,500 linear miles of magnetometer traverse were flown at a nominal 500-foot elevation. Large massive deposits in all instances gave negative anomalies, 3,000 to 5,000 gammas below the average plateau level, with very sharp gradients. Some ilmenite-rich anorthosite also produced negative anomalies but with less steep gradients. The strong negative anomalies are attributed to the effect of negative polarization in the ore body itself. Strong positive anomalies, often of the order of 4,000–5,000 gammas, at the granite-Morin series contact are probably due to concentrations of disseminated magnetite in the hybrid rocks of the contact zone.—*M. C. R.*

11815. Hurley, P. M. Airborne magnetic survey in Maine: Eng. and Min. Jour., vol. 150, no. 8, pp. 52–55, 1949.

An aeromagnetic survey of a 1,200-square-mile area in northwestern Maine was made in July 1948 as a rapid method of narrowing down areas of possible mineral occurrence. As asbestos, copper, chromite, and talc in nearby areas were known to be close to mafic or ultramafic bodies that normally show up in magnetic contrast, attention was centered on strong magnetic gradients. All anomalies were explained geologically except one inaccessible peak in Moosehead Lake. The magnetic contours conform almost identically with dikes in the belt of mixed sediments and igneous rocks and proved a most useful guide for plotting location of intruded masses beneath the overburden. Sections of ultramafic bodies with asbestos and talc mineralization were uniformly associated with magnetic peaks. Other highs resulted from ultramafic rocks in some places bordered by talc-carbonate zones. The magnetic survey also helped to distinguish a granite-gneiss contact by the difference in the magnetic patterns over the two bodies, the former producing more closed contour patterns, the latter intricate and continuing convolutions.

Curves are given for the vertical magnetic response from the vertical component of induced polarization above magnetite bearing bodies of small cross-section. In regions of high latitude the total field and the vertical component may be considered the same as an approximation.—*M. C. R.*

11816. U. S. Geological Survey. Total intensity aeromagnetic maps of Indiana. Geophysical Investigations preliminary maps, scale 1 inch=1 mile, contour interval=10 gammas, 1949 and 1950.

The following maps have been issued in the series of county maps based on a state wide aeromagnetic survey by the Geological Survey in cooperation with the Division of Geology of the Indiana Department of Conservation: Benton, Fulton, Jasper, Lake, LaPorte, Newton, Pulaski, Starke, and White Counties by W. J. Dempsey, J. R. Henderson, and R. T. Duffner, 1949; Posey County, by J. R. Henderson and J. L. Meuschke, 1949; Cass, Elkhart, Marshall, and St. Joseph Counties by Dempsey, Henderson, and Duffner, 1950; and Daviess, Dubois, Martin, Pike, Spencer, and Warrick Counties by Henderson and Meuschke, 1950.

The total magnetic intensity at about 1,000 feet above the surface of the ground is shown by contour lines. The purpose of the survey was to obtain information on the configuration of the crystalline basement rocks, variations in their composition, and relations to structures in the overlying sedimentary rocks, and to study the magnetic expressions of large-scale features, such as the regional tilt of the surfaces of the basement rocks. The survey may also aid in the search for geologic structures favorable to the accumulation of petroleum.—*M. C. R.*

11817. U. S. Geological Survey. Total intensity aeromagnetic maps of Minnesota. Geophysical Investigations preliminary maps, and accompanying profiles, scale 1 inch=1 mile, contour interval=50 gammas, 1949.

The following maps and profiles of a 9,250 square-mile area in north central Minnesota have been issued based on an aeromagnetic survey by the Geological Survey in cooperation with the Minnesota Geological Survey: Wadena County and part of Hubbard County, Todd County by J. R. Balsley, M. E. Hill, and J. L. Meuschke; southern Beltrami, northern Cass, central Cass, southern Cass, northern Crow Wing and part of Itasca, southern Crow Wing, part of Hubbard, western Itasca, eastern Morrison, and western Morrison Counties by J. R. Henderson, M. E. Hill, and J. L. Meuschke.

The total magnetic intensity at about 1,000 feet above the surface of the ground is shown. Larger trends are shown on magnetic contour maps, but comparatively small anomalies are shown as magnetic profiles. The purpose of the survey was to delineate major magnetic trends associated with known deposits of iron ore and to indicate areas under the glacial overburden which may be favorable for additional exploration.—*M. C. R.*

11818. U. S. Geological Survey. Total intensity aeromagnetic maps of Missouri. Geophysical Investigations preliminary maps, scale 2 inches=1 mile, contour interval=50 gammas, 1949.

The following maps of approximately 2,500 square miles of southeastern Missouri have been issued based on an aeromagnetic survey by the Geological Survey in cooperation with the Missouri Geological Survey: part of St. Clair, Coldwater, Des Arc, DeSoto, Farmington and part of Crystal City, Fredericktown, Ironton, and Richwoods quadrangles by W. J. Dempsey and R. T. Duffner.

The total magnetic intensity at about 1,000 feet above the surface of the ground is shown by contour lines. The survey was made to obtain information on the structure of the crystalline basement rocks, variations in their composition, and their relation to structures in the overlying sedimentary rocks, some of which may be favorable for the occurrence of lead deposits.—*M. C. R.*

11819. Weiss, Oscar. Aerial magnetic survey of the Vredefort Dome in the Union of South Africa: Mining Engineering, vol. 1, no. 12, pp. 433–438, 1949.

An aerial magnetometer survey was made over the Vredefort dome, where Witwatersrand beds surround a granite plug 25 to 30 miles in diameter. A narrow belt of sharp negative anomalies (−1,000 to −2,000 gammas) follows the outcrop of the Lower Witwatersrand shales, although elsewhere these same shales cause positive anomalies. The width of the belt is 13,000 to 28,000 feet, increasing with intensity. The negative polarization may have been caused by heat and stresses connected with the doming. The anomalies become weaker where the Karroo sediments and dolerite sills begin to cover the shales, and become positive where the shales disappear beneath the sediments. This is attributed to faulting which has truncated the nearly vertical shales at depth.—*M. C. R.*

11820. Good, S. E., and Pettijohn, F. J. Magnetic survey and geology of the Stager area, Iron County, Mich.: U. S. Geol. Survey Circ. 55, 4 pp., 3 maps, 1949.

As part of a general restudy of the Iron River-Crystal Falls district, most of the Stager area was surveyed with a Wolfson magnetometer, with readings made at 100-foot intervals along traverses approximately 200 feet apart. Magnetic values are shown as departures measured in gammas from the Iron County standard. The contours are parallel to the strike of the beds and magnetic "crests" are associated with a magnetic slate member of the hanging wall strata and the iron-formation.—*M. C. R.*

SEISMIC METHODS[1]

11821. Berson, I. S. Indicator curves of the average seismic velocities in stratified media [in Russian]: Akad. Nauk SSSR Izv., ser. geog. i geofiz., vol. 13, no. 2, pp. 129–142, 1949.

Differences in velocities in vertical and horizontal directions frequently found in seismic prospecting may indicate either anisotropy or simple stratification, with each layer being completely isotropic. The effective and average velocities in a stratified medium are analyzed, assuming the measurements are made along lines either parallel or perpendicular to the stratification, and introducing the indicator curve or the polar diagram of the velocity variation with direction. Analysis of the corresponding shapes of these indicator curves will then make it possible to decide if the medium is anisotropic or composed of parallel isotropic strata. The possibility, long ago surmised by practical seismologists, is confirmed that one thin (10–20 cm.) layer with much higher velocity can so affect the seismic data that the medium appears anisotropic although it is essentially isotropic.—*S. T. V.*

11822. Howell, B. F. Jr. Ground vibrations near explosions: Seismol. Soc. America Bull., vol. 39, no. 4, pp. 285–310, 1949.

To increase knowledge of the basic seismic forms to be expected on the record of explosions, measurements were made at 14 locations along a line 97 to 3,284 meters from a series of small blasts. Recording was by three electromagnetic induction seismometers, two horizontal and one vertical; three amplifiers, and a recording oscillograph. The following pulses were recognized on the records: P, the first to arrive; P_3, a compressional pulse arriving later than P; X_1 X_2 X_3, assumed to be body waves traveling along deeper paths than P and P_3; C, resembling Leet's "coupled" wave, but confined almost entirely to the longitudinal component; T, motion on the transverse component arriving nearly coincident with C; H, similar to Leet's hydrodynamic wave, with direct elliptical motion in a vertical plane; and R, a Rayleigh type motion. No satisfactory theory for C, H, and R is known.—*M. C. R.*

11823. Handley, A. J. Geophysical reflections [in English and Spanish]: Petroleo Interamericano, vol. 7, no. 12, pp. 54–55, 57, 1949.

To aid geologic interpretation of seismic reflections in exploration it is considered desirable to run velocity tests in all dry holes and calibrate reflection times in terms of geologic interfaces. A common practice is to place the seismic reflection record along the time axis, and the electrical well log along the depth axis on the graph of the velocity test so that reflection times can be related to log data. In many areas reflections have been correlated more closely with the self-potential curve than with the resistivity curve, confirming the observation that velocity changes depend on density variations, as the self-potential curve is more representative of porosity, and thus of density, than the resistivity curve. Accordingly reflections should be studied with reference to any pronounced self-potential kicks, correlated through several holes, and be traced to the corresponding geologic horizons.—*V. S.*

---

[1] See also Geophys. Abstracts 11704, 11710–11712.

11824. Petroleo Interamericano. Surface seismic shooting [in English and Spanish]: vol. 7, no. 9, pp. 54–55, 1949.

A description of the Poulter method.—*V. S.*

11825. Texas Oil Journal. New method of seismic exploration may cut costs and speed search for new oil: Vol. 15, no. 8, pp. 10–11, 26–27, 1948.

The development, principles, advantages and procedure of the Poulter method of surface shooting in seismic exploration are outlined.—*V. S.*

11826. World Petroleum. New method of seismic exploration for oil: Vol. 19, no. 13, pp. 52–53, 1948.

The Poulter method of seismic exploration is described. For a complete description of the method, *see* Geophysical Abstract 11539.—*V. S.*

11827. Guseman, L. F. Geophysics accepts a challenge: Oil, vol. 8, no 12, pp. 16–17, 1949.

The development of marine seismic exploration is traced briefly from initial near-shore work in calm weather, with bottom charges and position fixing from land, to the current use of drag cables for geophones, refined techniques, larger boats, and radar for surveying, permitting faster and more accurate work farther offshore and in rougher weather. In the Gulf of Mexico surveys are now made at distances of 50 to 75 miles from land.—*V. S.*

11828. Petroleum World. Sea-borne seismic work under way off California coast: Vol. 45, no. 8, pp. 15–17, 1948.

Brief remarks on present and past seismic exploration off the California coast, the equipment used, the monthly costs per crew, comparison of operations with those in the Gulf of Mexico, and potentialities of the continental shelf.—*V. S.*

11829. Agnich, F. J. Geophysical exploration for limestone reefs: Geophysics, vol. 14, no. 4, pp. 486–500, 1949.

The value of various geophysical methods in locating limestone reefs is discussed. Adequate appraisal of the gravity method is impossible because of the small amount of drilling that has been done. Effectiveness of the seismic refraction method depends on the thickness of the reef and the velocity differential between the reef and the surrounding materials. The greatest success in locating reefs has been by use of the reflection survey.

In west and central Texas, usable reflections are not obtained from the reef surface and the problem must be worked in an indirect manner. Where off-reef sediments are predominantly shales, appreciable structure may be developed above the reef by differential compaction, but the structural effect will be slight or absent where the reef is surrounded by sands or limestone. Thus knowledge of the off-reef sediments is necessary to know what significance should be assigned to small, shallow, closed areas. If the reefs have a considerably greater velocity than the off-reef sediments, deep reflections will indicate false closures. A time isopach map between a shallow and a deep reflection will show an amount of thinning much greater than expected and the results can be interpreted as indicating reefs. Where no appreciable velocity contrast exists and where shallow folding due to compaction is present, an isopach between a horizon above the reef and one below will show a thick section. Such a thick section below a shallow fold will be strongly indicative of the presence of a reef.—*M. C. R.*

ELECTRICAL METHODS

11830. Fiano, R. G. Casi particolari di curve indicatrici nei metodi di prospezione elettromagnetica [Special cases of the indicatrix curve in electromagnetic prospecting methods]: Annali Geofis., vol. 2, no. 3, pp. 359–369, 1949.

This article continues C. Aquilina's study (*see* Geophysical Abstracts 134, no. 10339) on the use of the indicatrix curve in electromagnetic prospecting, to the cases in which the primary field is directed horizontally. The secondary magnetic field is represented by two coils both placed in vertical planes in different relative positions and at different heights over the plane of the ground. Eleven arrangements of the coils represent a body buried at different depths and with varying dips. The corresponding equations of the indicatrix curves are derived, their coefficients calculated and the graphs of the curves are given. The purpose of the study is to facilitate the interpretation of the curves obtained in the field by providing approximations corresponding to known geophysical conditions.—*S. T. V.*

11831. Belluigi, Arnoldo. Inductive coupling of a homogeneous ground with a vertical coil: Geophysics, vol. 14, no. 4, pp. 501–507, 1949.

The analytical solution is given for the problem of the electromagnetic field of a harmonically varying magnetic pole at or above the surface of an earth of uniform electrical conductivity. Assuming a magnetic susceptibility of unity everywhere, the boundary conditions permit complete solutions for the horizontal component, H_ρ, and the vertical component, H_z, of the magnetic vector.

The tangential and radial components of the magnetic field produced over the ground by a harmonically varying magnetic dipole at the surface are expressed in terms of $H\rho$ and $\partial H\rho/\partial\rho$. Expressions are given for the ratio of the components of the varying fields to the corresponding components of the stationary fields produced by a magnetic pole or a magnetic dipole. At great distances from the source these ratios approach 2.—*I. Z.* and *R. G. H.*

11832. Gilchrist, Lachlan, Rostoker, Normon, and Bernholtz, Ben. Distribution of potential in a two-layered medium due to an internal source and sink and the determination of the approximate average resistivity of the medium: Canadian Jour. Research, sec. A, vol. 28, no. 1, pp. 1–27, 1950.

A brief review of resistivity investigations is presented including various electrode arrangements on the upper surface of a two-layered medium. The formulas relating interbowl resistance R and resistivity ρ are given for each case. However, it is emphasized that they apply rigorously only to a homogeneous medium. An interpretation based upon these formulas becomes, then, an interpretation of the divergences of experimentally determined values of R and ρ from values calculated for a homogeneous medium. As R for the homogeneous medium is affected by uncertainties, more adequate formulas are required.

Single drill holes, and drill holes in pairs have been used extensively to introduce sources and sinks into layered media. In this type of exploration the formulas for a homogeneous medium are also inadequate; nevertheless informing comparisons of experimentally measured values of R with calculated values are sometimes possible.

In the mathematical development of satisfactory formulas for a source or sink in a two layered earth, two approaches are presented: the method of electrical images; and solution of the Laplace equation subject to prescribed boundary conditions. Either approach leads to identical series representations of the distribution of electrical potential in the layers. Theoretical and experimental results involving the use of the derived formulas are presented in the form of curves, from which it is observed that the potential distribution changes in such a manner as to reveal the approximate position of the interface. Also theoretical curves of interdrill hole resistance plotted against depth for various ratios of overburden resistivity to lower layer resistivity can be used to obtain the approximate depth of the interface. At depths sufficiently remote from the overburden, the influence of the upper layer becomes small and simpler formulas can be used.

It is important in resistivity measurements that the sink and source be of equal magnitude and that an infinite plane bisecting the region of exploration be the equipotential face of zero value.—*R. G. H.* and *I. Z.*

11833. Lipskaia͡, N. V. The pattern of the electric field produced by a point source as observed on the earth's surface near a buried conductive sphere. [in Russian]: Akad. Nauk SSSR Izv., ser. geog. i geofiz., vol. 13, no. 5, pp. 409–427, 1949.

The common practice in electrical surveying, when calculating the intensity of anomalies caused by underground bodies, of allowing for the influence of the earth's surface by doubling the anomaly calculated for an infinite space results in serious errors when the depth of the disturbing body is small. An accurate solution when the inhomogeneity is spherical and has a very high conductivity as compared with that of the surrounding medium is obtained by the method of electric images, successively applied. The solution is given as three consecutive approximations of increasing accuracy. The convergence of the approximations is proven. The point electrode as the source of the electric field was chosen because the solution can be easily extended to the problem of linear electrodes or to combinations of several point electrodes.

The method suggested by B. Riemann for a more general problem of two electrically charged bodies, placed in any relative position has been followed. From the general formula particular solutions were derived and numerical values computed for four depths of the disturbing sphere. The results are presented in the form of graphs. From these equipotential lines on the earth's surface are traced. Finally the apparent resistivity of the ground is calculated and the results are compared with the data determined by A. S. Semenov and later experimentally checked by him on a model. The values are in good agreement with the theoretically accurate results, beginning with the third approximation. The first approximation, often made in practical work, can result in an error of as much as 40 percent, if the depth of the disturbing body is not great.—*S. T. V.*

11834. Petrucci, G. L'importanza della rappresentazione dell' andamento del campo elettrico nella prospezione con il metodo dei potenziali naturali [Importance of the analysis of the variation of the electrical field in prospecting by the self-potential method]: Riv. Geomin., vol. 9, no. 2, pp. 83–88, 1948.

The self-potential method is based on the fact that many kinds of ore deposits, such as iron, lead, copper, and graphite generate by oxidation electrical currents in the ground. But electrical currents can also be produced by decomposition of the surrounding rocks or by contact of geological formations of different chemical composition causing very similar variations of the electrical potential on the surface. Further with stratified ore deposits the self-potential method does not allow a clear geological interpretation.

If instead of tracing the self-potential diagram, the curve of the variation of the electrical field along the same profile is constructed, it becomes possible to discover stratified deposits because the intensity of the electric field at a point represents practically the rate of variation of the potential per meter, whereas the potential at the same point is the result of the algebraic summation of all the variations along the profile from the point of departure. Electrical field intensity is determined by the electrical conditions in the immediate vicinity of the point, the potential is the final result of all preceding points. Several curves of the electrical field and of the potential obtained when prospecting for stratified anthracites are reproduced. Parallel analysis of these curves shows the advantages of using the curve for the electrical field, as it is more accentuated and more sensitive to local influences.—*S. T. V.*

11835. Calhoun, J. C., Jr. Correlation of formation-resistivity factor with porosity: Oil and Gas Jour., vol. 48, no. 26, p. 95, 1949.

For a porous body, containing only straight parallel capillaries in which the resistivity is measured with electrodes placed at the ends of the system, the equation $F=\rho_\omega/\rho_\omega'=1/\Phi$ is derived, where F is the resistivity factor, Φ the porosity, $\rho\omega$ is the resistivity of section when fully saturated with a saline solution, and ρ_ω' the resistivity of the saline solution itself. However, the general formula for any shape of capillaries is $F=\Phi^{-m}$, in which m depends upon the amount of cementation, and usually ranges between 1.3 and 2.5. Thus material of ordinary porosity cannot be expected to conduct electricity in direct proportion to the volume of conducting fluid it contains but will be something less than this maximum because of the irregular pore geometry, with the exponent m being the measure of this irregularity. Graphs of $\log F=-m \log \Phi$, are given for values of m ranging from 1.0 to 2.0.—*V. S.*

11836. Kruger, F. C. and Lacy, W. C. Geological explanation of geophysical anomalies near Cerro de Pasco, Peru: Econ. Geology, vol. 44, no. 6, pp. 485–491, 1949.

Spontaneous polarization and resistivity surveys of an area containing scattered outcrops of gossan at Venencocha on the northwest side of the Cerro de Pasco vent indicated two conspicuous anomalies. Diamond drilling in the area yielded little or no sulfides, so a petrologic study of the cores was undertaken. Similarities in outlines of the spontaneous polarization equipotentials and the distribution of alunite and of the resistivity survey and the distribution of quartz suggest a cause-effect relationship. It is suggested that a body of sulfides that existed above the present surface was removed by erosion and glaciation leaving only the underlying portion of its halo of alteration.—*S. T. V.*

11837. Metzger, A. A. T. Contributions à l'étude électrique des depôts quaternaires [Contributions to the question of electric exploration of Quaternary deposits]: Géol. Finlande Bull. no. 144, pp. 3–8, 1949.

Procedures used in the determination of the thickness of unconsolidated formations overlying "crystallophylien" horizons by electrical methods are described. It is necessary to distinguish between the moraines formed during glaciation and the deposits of sand, clay, or gravel of postglacial origin. The resistivity of these sediments is determined by their water content and mineralization, the water content being highest in the clay deposits and sometimes completely lacking in gravel and sand deposits. The potential-drop ratio method was used with alternating current of 200 hertz frequency, produced by a small gasoline motor coupled to a generator, or by an oscillator. In resistivity measurements Wenner's scheme was usually employed with very short electrode separation, never exceeding one tenth of the supposed thickness of the formation. A report on such measurements made on different terrain and in different regions of Finland is presented and the results are reproduced in graphs and charts. These findings were in many cases checked by drilling and consequent electrical logging of the drill holes. The results of the eletrical measurements were quite satisfactory.—*S. T. V.*

11838. Perret, W. R. Electrical resistivity exploration as a complement to boring in deep alluvial deposits: Internat. Conference on Soil Mechanics and Foundation Engineering, 2d, Rotterdam 1948, Proc., vol. 7, pp. 80–84, 1949.

Electrical resistivity surveys were made to delineate the subsurface structure along the levees on the east bank of the Mississippi River, and especially to determine the interface between the younger alluvial deposits and the Tertiary marine clay which underlies the lower Mississippi Valley. Resistivity-depth measurements using the Wenner configuration were made at 1,000 foot intervals and the depth to the Tertiary clay was determined at 194 places. This determination was based on the fact that clays in which permeability is low and soluble minerals are prevalent have high conductivity, whereas clean river sands have low conductivity. Interpretation of the measurements was by the curve-matching method, using two- and three-layer standard curves. The results of check tests by borings agreed with the data obtained from electrical measurements within 3.5 percent.—*S. T. V.*

11839. Fritsch, Volker. Mitteilung über einige in dem letzten Jahren durchgeführte Untersuchungen auf dem Gebiete der Funkgeologie [Note on some recent investigations by the radio wave method]: Schweizer. min. pet. Mitt, vol. 29, no. 1, pp. 19–42, 1949.

Geophysical investigations by the radio wave method in exploration for coal, potassium, and iron ores and studies of geological structure around dam sites are reviewed.

Radio waves of different frequencies have been used, their transmission through the ground measured, and the damping capacity of different geological formations observed as a function of the resistivity and dielectric constant. Transmissibility of the ground near potassium mines in Germany was found especially great, being 14 kilometers for a frequency of 3,000 kilohertz with a transmitter of only 15 watts. For other formations this transmissibility is smaller, but measurable in kilometers for those not containing too much water. The method is especially well adapted for hydrological exploration. With capacity substituted the method has been successfully used for deep sounding. For shallow layers resistivity measurements with very high frequency were used and special equipment developed for this purpose.—*S. T. V.*

RADIOACTIVE METHODS

11840. Western Miner. New use for Geiger counter: vol. 22, no. 8, p. 96, 1949.

Progress in the adaptation of the Geiger-Müller counter to prospecting for radioactive minerals is reported. New techniques in constructing electronic circuits have made possible the design of portable models weighing 6 to 11 pounds and a pocket model weighing 1 pound. A counter has also been designed which can be lowered in a drill hole on a cable over 1,000 feet long without interference with the voltage pulse of the G–M tube.—*V. S.*

11841. Aliverti, Giuseppina. Considerazioni, sui metodi di misura della radioattivita in uso nella prospezione geofisica [Methods of radioactivity measurement in geophysical prospecting]: Riv. Geomin., vol. 10, no. 1, pp. 13–16, 1949.

Radioactive methods used in prospecting for oil, in exploration of geological structures, and in searching for radioactive minerals are reviewed. Included also are methods for measuring the radioactivity of soil for K^{40} content. Results of the radioactivity determinations of different minerals and rock formations are given. The possibility is mentioned of using the secondary radiation, induced by an initial neutron irradiation of the rock, in prospecting for manganese, gold, tungsten, copper, arsenic, sodium, potassium, and phosphorus.—*S. T. V.*

11842. Marcuse, H. Uranium—Mineral of the future: Min. Geol. Jour., vol. 3, no. 6, pp. 7–8, 1949.

This is a resumé of a booklet prepared by the Australian Commonwealth Bureau of Mineral Resources for guidance of prospectors for radioactive minerals in Australia.—*S. T. V.*

WELL LOGGING

11843. Doll, H. G., Legrand, J. C., and Stratton, E. F. Electric logging systems [in English and Spanish]: Petroleo Interamericano, vol. 7, no. 12, pp. 66–71, 1949.

Factors affecting resistivity logging of bore holes are pointed out briefly, and the operation and suitable application of the single-electrode and the four-electrode (normal and lateral) systems are explained and illustrated by diagrams. Usually, two different arrangements are run in the same hole to obtain complete data, as some of them are more adequate than others for thin or thick strata, for small or great mud invasion, and for shallow or deep investigation.—*V. S.*

11844. Stick, J. C. Jr., Baker, J. S., and Norelius, R. G. New electrical logging techniques in California: Tomorrow's Tools Today, vol. 13, no. 2, pp. 17–21, 1947.

Difficulty in interpreting electrical resistivity logs in California oil fields, where formation waters sometimes have a high and fluctuating resistivity, may be overcome by estimating the water saturation of sand formations in wells from log curves of mud invasion, the idea being that water-saturated sand has a higher permeability to such invasion than sand containing oil. The resistivity of the mud is lowered at the time of drilling by suitable treatment to a value below that of formation water. The lateral depth of invasion is determined by a series of shallow-penetration resistivity logs progressively increasing the penetration depth until a measurement is made of the uncontaminated formation. The sections of logs with a resistivity sufficiently high to indicate possible oil sand are then examined to determine whether the resistivity recorded by the shallowest curves has been reduced by penetration of the mud filtrate. If this resistivity has not been reduced, the sand is likely to contain oil. Sands selected as promising must be further graded by comparing their true resistivities to eliminate those which may be silts.—*V. S.*

11845. Wyllie, M. R. J. Statistical study of accuracy of some connate-water resistivity determinations made from self-potential log data: Am. Assoc. Petroleum Geologists Bull., vol. 33, no. 11, pp. 1892–1900, 1949.

The usefulness and limitations of self-potential logs for determining connate-water resistivity are shown by statistical comparison between 39 values computed from routine logs of Illinois, Oklahoma, and Kentucky oil fields and the measured resistivities. In general, the theoretical interpretation of the electrochemical e. m. f. gives correct connate-water resistivities only for self-potential kicks referring to thick, relatively low-resistivity formations and those with little shale interbedding. Computed resistivities average somewhat too high for grossly pointed or very serrated self-potential kicks. Significant correlation was found between the magnitude of the errors and the resistivities of Aquagel muds used in logging. No significant relation was found between the errors and the salinity of the connate-waters studied. No satisfactory explanation has been found for the abnormally low computed resistivities in the McClosky producing zone.—*M. C. R.*

11846. Mercier, V. J. Well logging in limestone areas, radioactive vs. electrical: Tomorrow's Tools Today, vol. 13, no. 1, pp. 4–7, 1947.

The advantages and limitations of radioactive and electrical logs of wells in limestone are discussed briefly with respect to the nature of strata, detection of oil or gas, persistence of vertical variations laterally to provide good correlations, suitability for various bore-hole conditions, locations of porous strata, economy of operation, and simplicity of interpretation. Radioactive logging is apparently more versatile and generally more usable than electrical logging in limestone areas.—*V. S.*

11847. Tiratsoo, E. N. Radioactivity well logging: Petroleum, vol. 11, no. 1, pp. 2–6, 26, 1948.

The nature of radioactivity is explained. The theory and practice of gamma-ray and neutron logging of wells are discussed and illustrated by examples of log curves, and useful applications of logs are listed.—*V. S.*

11848. Faul, Henry, Tittle, C. W., and Goodman, Clark. Neutron logging of drill holes [abstract]: Geol. Soc. America Bull., vol. 60, no. 12, pt. 2, pp. 1886–1887, 1949.

Distribution of thermal and indium resonance neutrons and intensity of secondary gamma radiation have been measured in continuous media and in simulated drill holes, cased and uncased, empty and water-filled. Water, barite-drilling mud, water-saturated sand, moist sand, and brine-saturated sand were investigated. Neutron distributions in water and drilling mud (density 1.4) are nearly identical.

In a 6-inch well, the intensity of neutron-capture gamma rays increases with hydrogen content at points within 16 inches of the neutron source and decreases at more distant points. Absolute gamma intensity is greatly reduced by introduction of nonhydrogenous absorbers (as lead and boron) between logging probe and formation. The slope of logarithmic intensity against distance remains virtually constant. It changes with the hydrogen content of the formation and offers a means of quantitatively estimating porosity behind casing despite extraneous absorption. Hydrogeneous material between probe and rock increases the slope. Two or three inches of mud seriously impairs the sensitivity.—*M. C. R.*

11849. Tittle, C. W., Goodman, Clark, and Faul, Henry. Nuclear radiations in well logging [abstract]: Geol. Soc. America Bull., vol. 60, no. 12, pt. 2, pp. 1923–1924, 1949.

Applications and limitations of radioactivity-logging techniques have been defined largely by experience. Laboratory studies are now being made of the slowing down and diffusion of neutrons, the production and absorption of gamma rays from inelastic scattering and radiative capture of neutrons, and the distribution and absorption of neutrons and of gamma rays under conditions simulating field operations. It is tentatively concluded that the possibilities and limitations of present logging techniques can be established; that increased knowledge of subsurface conditions should result from improvements in present operating procedures; and that neutron flux measurements, when made simultaneously at several points along the axis of the drill hole in the vicinity of a porous formation, can, under favorable conditions, distinguish between oil (and/or fresh water) and salt water.—*M. C. R.*

11850. Bush, R. E. Radioactivity well log interpretation in the East Texas Field: Tomorrow's Tools Today, vol. 13, no. 2, pp. 13–16, 1947.

Gamma-ray and neutron logs in the East Texas Field may aid the reworking of wells flooded by the water drive for maintenance of reservoir pressure. Three generalized cross sections from west to east show that the Eagleford shale is pinched out against the Austin chalk half way across the field and that the producing Woodbine sand is directly below them. Advantageously, the Eagleford shale registers high radioactive intensities, the top of the Austin chalk is marked by a distinct break in these intensities, and the Woodbine sand gives low values. However, the producing sand is broken by non-continuous shale lenses, as shown on a north to south section, and logging is essential in every well reworked. Examples are given of the use of logs in plug-back and deepening operations and of gamma-ray neutron logging in a cased-in well. Combined logging is found advantageous because the neutron curve gives high values for chalk, indicates fluid-bearing portions of the sands, defines bottom of casing and top of liner, and singles out washed-out shale sections.—*V. S.*

11851. Bush, R. E., and Campbell, J. L. P. Limestone completions through radioactivity logs: Tomorrow's Tools Today, vol. 14, no. 1, pp. 4–9, 1948.

Six examples of interpretation of electrical and radioactivity logs in the limestone and sandstone areas of eastern Texas, northern Louisiana, and Arkansas show the advantages of combining these logs for oil-well completions. A low neutron value indicates fluid without differentiating between salt water, fresh water, and oil, whereas low resistivity usually signifies salt water, so that a zone with a low neutron value and high resistivity may contain oil, but a zone with high neutron and resistivity values is likely to be dense. Similarly, a self-potential log alone may be insufficient to distinguish between porous limestone and sandstone, and resistivity indications of oil or gas in limestone, used singly, may be obscured by the effects of a dense cap or intermediate streaks. The combination of the two logs tends also to reduce errors in measurements of depth of formation.—*V. S.*

11852. Campbell, J. L. P., and Winter, A. B. Dry gas sand location by neutron logs: Tomorrow's Tools Today, vol. 13, no. 1, pp. 22–23, 31, 1947.

Dry gas sands have recently been found to appear as high intensities on the gamma ray curve in many areas. Examples of logs illustrate detection of these sands from high neutron values in a faulted area, a Woodbine sand, and a salt dome. The best indications are obtained when the fluid content of the gas sand is less than one gallon of gasoline per 1,000 cubic feet, as wetter sands register insufficiently distinctive neutron intensities. A limiting factor in detection is the water trapped during well-cementing and completion operations because its invasion of formations may cause variations of log values.—*V. S.*

11853. Mercier, V. J. Radioactivity logs don a "new look": Tomorrow's Tools Today, vol. 14, no. 1, pp. 30–32, 1948.

Two types of new forms for radioactivity logging have been developed to meet specific requirements of different localities and take account of advancing techniques. They may be used for recording the gamma-ray curve, the neutron curve, or both curves on a combination log, and are suitable for use at a scale of 1 inch per 100 feet, 2 inches per 100 feet, and 5 inches per 100 feet. The form entries deserving note are discussed, and examples are given of a combination log typical of the Gulf Coast and of the mid-Continent region.—*V. S.*

11854. Norelius, R. G. Improved radioactivity logging for California: Tomorrow's Tools Today, vol. 13, no. 3, pp. 11–13, 1947.

Relatively unsatisfactory radioactivity logs in California are found to be due to a lower general level of radioactivity than in rocks of the Gulf Coast and the mid-Continent, and a smaller contrast in radioactivity between formations. To offset this the speed of logging has been reduced to increase the time for which emission is averaged at each point, and the sensitivity of equipment has been increased by using longer or larger ionization chambers. Both measures improve directly the log's accuracy because the deflection of the recording pen is directly proportional to both the number and intensity of gamma rays passing through the ionization chamber per second. Curves show the decline in the percentage of meaningless variations with an increase in the number of the gamma rays counted. The improved logs obtained with new instruments and suitable logging speeds are shown. These logs are now comparable in accuracy to logs in other regions.—*V. S.*

11855. Woodward, M. E. Oil wells with new life through radioactivity logs: Tomorrow's Tools Today, vol. 13, no. 3, pp. 18–19, 34, 1947.

The usefulness of radioactivity logs in work-over operations is illustrated by their application in the Government Wells Field of south Texas, discovered in 1928 and originally worked on the basis of drillers' logs and core information. The field has produced primarily from the Government Wells sand at an average depth of 2,200 feet, and work-over operations involve the Cole sands at about 1,580 to 1,850 feet. The sands themselves are low in radioactivity, but the contaminating shales and their components—ash, silt, and organic material—register moderate to high values on logs, making correlations possible. The logs of 4 wells are discussed in connection with plug back operations performed with their aid, and samples of log curves are shown.—*V. S.*

11856. Carlson, R. F. Portable mud-logging equipment in Elk City field: Oil and Gas Jour., vol. 48, no. 26, pp. 68–69, 1949.

Trailer-borne mud-logging equipment, including a fluorescence-measuring device, a drilling-time indicator, and a gas analyzer, used in the Elk City oil field, Oklahoma, furnishes general daily reports on formations penetrated in a well and detailed summaries of lithology, mud history, bit record, drilling rate, and oil and gas content of the mud and cuttings. In the gas analyzer air is forced through thoroughly mixed cuttings and any picked-up gas is carried over an ignition element which is an arm of a Wheatstone bridge. Burning of a combustible gas heats the elements and unbalances the bridge by a change of resistance, thus registering on a galvanometer the amount of gas present. A change of voltage across the bridge controls the temperature of the element and permits distinguishing between gases by their ignition temperatures.—*V. S.*

11857. Nichols, P. B. Geolograph aids drilling operations [in English and Spanish]: Petroleo Interamericano, vol. 7, no. 8, pp. 42–43, 1949.

The geolograph is an automatic recorder of the rates of penetration of the bit during rotary drilling of wells. It traces a continuous log on a 24-hour strip-chart divided into 1- or 2-minute divisions, indicating by a separate line the length of time necessary to drill each successive foot. The construction and uses of the instrument are described. The geolograph can serve for determining formation tops, thicknesses of beds, zones of porosity in limes and dolomites, packer points in drill-stem testing, and other drilling factors. The drilling-rate curve has been found often closely to parallel the self potential of the electric log.—*V. S.*

TECHNICAL AIDS

11858. Aslakson, C. I. Velocity of electromagnetic waves: Nature, vol. 164, no. 4173, pp. 711–712, 1949.

The velocity of propagation of ultra-high-frequency radio waves, used in geodetic measurements by shoran, has been determined as 299.792 km./sec. This value is close to those recently found by Essen, Bergstrand, and Jones and Cornford, but different from the generally accepted value of 299.776 km./sec. of Anderson and others. The minimum sum distances between the two ground stations were determined analytically as an aircraft flew across the line between the stations. The velocity assumed in the design of the shoran computer was 299.776 km./sec., and 47 lines were measured, varying from 67 to 367 miles in length. The actual velocity was determined in two ways. The first was based on a comparison of 6 shoran-measured distances with proper values of U. S. Coast and Geodetic Survey triangulations and the calculation of increments to the assumed computed velocity. In the second, the remaining 41 lines were adjusted by a method of least squares, introducing a multiplier for determining the ratio of the increase in length of all these lines to produce the minimum necessary correction. Both methods gave the same value of velocity.—*V. S.*

11859. Halliday, D. J. Geodetic measurements by radar: Nature, vol. 164, no. 4180, pp. 1005–1006, 1949.

The precision of geodetic measurements by radar was determined experimentally in Italy in 1945 by flying circular arcs at altitudes from 10,000 to 15,000 feet, centered upon a ground radar beacon, while recording the distance from a second beacon at regular intervals of 1 to 2 seconds, and then computing the geodetic distance between the two beacons from the radius of the arc and the minimum recorded distance from the beacon. Calculations included corrections for altitude and for refraction. Comparison with measurements by triangulation showed the radar determinations to be accurate within 1 part in 25,000 and 1 part in 30,000 in the two tests. Limited accuracy is attributed to lack of knowledge concerning variations in refraction and hence in velocity of wave propagation—*V. S.*

11860. Mott, P. G. Aerial surveying, applications in petroleum exploration and exploitation, pts. 1–2: Petroleum, vol. 11, no. 9, pp. 197–201, 203, no. 10, pp. 231–233, 1948.

Applications of aerophotogeology to petroleum exploration in undeveloped areas, production of contoured maps by photogrammetric methods for geologic mapping, and reconnaissance work for exploitation purposes are described.—*V. S.*

11861. Western Miner. Aerial survey: vol. 22, no. 10, pp. 77–79, 1949.

The procedures of mapping from aerial photographs, their advantages, accuracy, instruments used, climatic conditions, operation of the Bausch and Lomb Multiplex stereoprojection unit and applications to geologic surveying are outlined.—*V. S.*

11862. Haskell, N. A. A substitution method for the absolute calibration of vibration pick-ups: Geophysics, vol. 14, no. 4, pp. 558–561, 1949.

A method of calibration similar to that used in acoustic measurements in fluid media may be used for electro-mechanical devices intended to measure the vibrations of a solid medium. The relations between input and output currents and voltages in four-terminal networks of bilateral impedances make it possible to derive a relation between the velocity response of a reversible vibration pick-up and the velocity output when used as a source of mechanical vibrations. Any vibration pick-up may be calibrated in absolute terms as a function of frequency by purely electrical measurements (input current and output voltage) made on the given pick-up, an auxiliary reversible pick-up, and a variable frequency driver.—*M. C. R.*

11863. Stripling, A. A., Broding, R. A., and Wilhelm, E. S. Elevation surveying by precision barometric means: Geophysics, vol. 14, no. 4, pp. 543–557, 1949.

A barometer of high sensitivity designed for use as an elevation meter is described. Changes in atmospheric pressure corresponding to changes in elevation are measured by measuring the changes in volume of an isothermal gas chamber required to maintain the chamber at atmospheric pressure. Changes equivalent to elevation differences of 0.1 foot are detectable. Two field techniques are described, and a typical survey around an 8-mile loop of 13 stations is presented in which the closure is 1.2 feet, and the average error is 0.8 foot.—*M. C. R.*

11864. Powell, C. Radio aids to oil exploration: Petroleum, vol. 12, no. 12, pp. 305–310, 312, 1949.

In the Decca Navigator or QM method of radio position fixing, a chain of three or four transmitters is set up at known points on the earth's surface and a receiver and special map with lines of constant phase difference are carried by the ship, plane, or vehicle using the chain. The method was originally developed for the British Admiralty during the Second World War.—*V. S.*

11865. World Petroleum. New system aids marine surveys: Vol. 19, no. 7, pp. 56–57, 1948.

The radio system of long-range accuracy surveying (Lorac), developed by J. E. Hawkins for marine seismic exploration, is operated with the use of two transmitting stations on land and two receiver sets and phase meters with counters on the survey boat. Position is determined by reading two counter dials and finding the intersection of two corresponding lines on a special chart plotted on the local map. Lorac operates on medium frequencies requiring no special height in receiving antennas and is expected to permit reliable surveys up to distances of 100 miles on sea and land.—*V. S.*

11866. Deegan, C. J. Helicopters now routine in oil exploration: Oil and Gas Jour., vol. 48, no. 31, pp. 79–81, 1949.

The use of helicopters in seismic and gravity exploration for oil is described. It is reported that 1,334 gravity stations have been occupied in a month with an average of 21.4 flying days. To speed location of ground positions, experiments are being made on the development of a lightweight shoran set.—*V. S.*

11867. Frank, Marco. Nuovo sistema di facsimile [New method of reproduction]: Annali Geofis., vol. 2, no. 4, pp. 532–544, 1949.

A new apparatus for reproducing graphs, meteorological data, seismograms, and similar material has been built on an electromechanical principle. Among its advantages are the immediate visibility of the material without photographic processes, and the ability to produce several copies simultaneously. The frequency modulation of the carrier wave may be as high as 3,500 cycles per second. Transmission of signals may be either by telegraph line or radio. A detailed description of the apparatus, including eight wiring diagrams and six pictures, is given.—*S. T. V.*

PATENTS

MAGNETIC METHODS

11868. Magnetic field angular gradientometer. James H. Stein, Toms River, N. J.: U. S. patent 2,490,102, issued December 6, 1949.

A device for measuring, in one operation, the angular gradient between two selected magnetic field components, said device comprising a rigid support having two magnetometers mounted at opposite ends thereon; an indicator having a rotatable circular scale mounted on its axis and a pointer mounted concentric to the axis of said scale; a control means associated with one of said magnetometers for aligning said magnetometer and said scale of said indicator in response to data therefrom, and means associated with the other of said magnetometers for aligning said other magnetometer and said pointer of said indicator in response to data therefrom. Claims allowed, 6.

11869. Magnetometer. Jacob H. Rubenstein, Buffalo, N. Y.: U. S. patent 2,493,779, issued January 10, 1950.

In a magnetometer having a pair of longitudinally spaced antenna members having high permeability and concentrating an external magnetic field in the space therebetween to provide oppositely polarized opposed ends, and a member for indicating changes in said field, the combination therewith of means actuating said indicating member in response to said changes, comprising a vane of magnetizable material pivoted at one side and having its free side interposed between said opposed ends of said antenna members, and a permanent magnet fixed to the pivoted side of said vane and arranged outside of said gap and polarizing said vane whereby said vane is swung toward one or the other of said opposed ends of said antenna members in response to changes in polarity thereof. Claims allowed, 4.

11870. Method and apparatus for determining magnetic properties of well cores. Henry N. Herrick, Berkeley, and William M. Schaufelberger, Whittier, Calif., assignors to California Research Corp., San Francisco, Calif., a corporation of Delaware: U. S. patent 2,500,680, issued March 14, 1950.

The method of determining the relation between the azimuthal relation of a predetermined point on the surface of a well core which is asymmetrically magnetized in an unknown direction, and the N–S magnetic axis of said core, comprising the steps of placing said core adjacent one of a pair of similar longitudinally aligned oppositely connected coils, rotating said coils about their longitudinal axis substantially at right angles to the approximate direction of the magnetic axis of said core, determining values of potential induced in said nearest coil at various azimuthal positions of said core, and observing the angular relation between those potential values which indicate the actual N–S magnetic axis and the said predetermined point on the surface of said core whereby its original position in the earth may be determined. Claims allowed, 2.

SEISMIC METHODS

11871. Apparatus for seismic prospecting. Raymond U. McKinney, Nowata, Okla., assignor, by mesne assignments, to Seismograph Service Corp., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,490,461, issued December 6, 1949.

Seismic prospecting apparatus comprising shot point and recorder stations in spaced relationship, a source of elastic waves at said shot point station, means at said shot point station for energizing said source, means for driving a record strip at said recorder, means including a timing motor for recording on said record strip spaced timing lines, means for recording on said record strip the instant of creation of said elastic waves, a first relay at said recorder station for controlling the operation of said first-mentioned means, adjustable means associated with said timing motor for periodically energizing said first relay in response to rotation of said timing motor, a second relay for preventing the energization of said first relay until said means for driving said record strip is energized, and means for adjusting said adjustable means so that the instant of creation of said elastic waves as recorded on said record strip coincides exactly with one of said timing lines produced on said record strip. Claims allowed, 10.

11872. Hydrophone. Eugene Merten, Houston, Tex., assignor to Shell Development Co., San Francisco, Calif., a corporation of Delaware: U. S. patent 2,490,595, issued December 6, 1949.

An apparatus for use in underwater seismic surveying operations, said apparatus comprising a fluid-tight housing having a cavity formed in the walls thereof, a resilient pressure responsive diaphragm closing said cavity in fluid-tight manner, a rod affixed at one end to the center of said diaphragm substantially perpendicularly thereto, magnet means having an annular air gap mounted in said housing, a coil coaxially affixed to said rod near the free end thereof, spring means affixed to said housing and the free end of said rod resiliently supporting said coil for axial motion in said gap, an axial passage in said magnet means forming guide means surrounding said rod, there being a close clearance between said passage and said rod to permit axial movement while substantially preventing transverse movement of said rod, whereby diaphragm deflections are transmitted to said coil solely in the direction of the axis of said rod, insulated conductor means passing through the walls of the casing and electrically connected to said coil, a chamber in said housing, communication means between the chamber and the cavity in the housing wall, port means in said housing wall to said chamber, and expansible diaphragm means closing said port means. Claims allowed, 3.

11873. Method and apparatus for detecting waves. Alexander McLean Nicolson, New York, N. Y.: U. S. patent 2,499,605, issued March 7, 1950.

A method of investigating the characteristics of an inhomogeneous medium comprising, simultaneously propagating a plurality of wave front components through the medium from a common origin, disposing wave responsive means at at least two points on the surface of the medium that are spaced apart with respect to the directions of propagation of two of said wave front components, obtaining indications of the order of arrival of said two wave front components at said respective wave responsive means, moving at least one of said wave responsive means to different points on the surface of said medium that are spaced apart from the other of said wave responsive means with respect to the directions of propagation of said two wave front components, and repeating said propagating and indicating obtaining steps while said one wave responsive means is located at said different points until a reversal in the order of arrival of said two wave front components at said respective wave responsive means occurs. Claims allowed, 8.

11874. Testing device for seismic signal apparatus. James E. Hawkins, Tulsa, Okla., assignor to Seismograph Service Corp., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,493,534, issued January 3, 1950.

The method of testing a seismic wave amplifier equipped with gain control facilities, which comprises generating a seismic wave train in the earth, detecting said wave train, distorting the relative amplitudes of the different components of said wave train, generating a signal representative of the degree of distortion of said different components of said wave train, synchronously recording said distorted wave train and said signal, synchronously reproducing said recorded wave train and said signal, varying the relative amplitudes of the components of said reproduced wave train in accordance with said reproduced signal, thereby substantially to eliminate the distortion of the relative amplitudes of the components of said wave train, impressing said reproduced wave train with the amplitude distortion eliminated therefrom upon said amplifier, and indicating the response of said amplifier to said wave train impressed thereon. Claims allowed, 12.

11875. Seismograph gain control system. Edwin J. Shimek, Dallas, Tex., assignor, by mesne assignments, to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,495,390, issued January 24, 1950.

A seismograph amplifier comprising a pair of vacuum tubes arranged in balanced circuit relation, grid-biasing means for applying between the respective signal grids and cathodes of said tubes a bias for operation of each tube at the same point on their respective characteristic curves, means including a resistor having a midportion connected to the cathodes of said tubes and the respective end portions connected to the signal grids of said tubes, a source of direct current potential connected to the respective end portions of said resistor to bias said tubes respectively in opposite senses and away from said point of said characteristic curves for raising the transmission level of seismic signals to a predetermined value by unbalancing said circuit relation, the output circuit of said vacuum tubes including a source of anode potential and a pair of similar resistors each connected to one of the anodes of said vacuum tubes, a bridge circuit having a first diagonal capacitively connected to the anode sides of said similar resistors, said bridge having a second diagonal, one end of which is connected to ground, and means including an amplifier having an input circuit connected to the other end of said second diagonal and responsive to output signals from said amplifier above a predetermined minimum level for applying a direct current biasing potential in opposition to said source of direct current potential simultaneously to change the bias on said tubes in directions for operation of each nearer said point on said characteristic curves to control the amplitude of the output signals, said bridge being adjustable to balance out any difference in anode currents due to characteristic curves for the respective tubes of different amplitude. Claims allowed, 2.

11876. Apparatus for recording time intervals. Arthur F. Hasbrook, San Antonio, Tex., assignor to Olive S. Petty, San Antonio, Tex.: U. S. patent 2,496,392, issued February 7, 1950.

In a system for marking timing indicia on seismic records and the like, the combination with devices responsive to electrical signal impulses for recording time lines on a record at intervals determined by the period of said impulses, of a pulse source for generating a first series of electrical impulses at a predetermined frequency, electronic means responsive to said first series of impulses for generating a second series of impulses at a frequency which is a sub-multiple of the frequency of said first series of impulses, and means impressing on said recording devices energy representative of both said first and second series of impulses to effect distinctive marking of time lines at intervals corresponding to the intervals between said second series of impulses. Claims allowed, 6.

11877. Seismic exploration system for determination of strata dips. Alexander Wolf, Houston, Tex., assignor to Texaco Development Corp., New York, N. Y., a corporation of Delaware: U. S. patent 2,496,648, issued February 7, 1950.

A method of seismic prospecting wherein it is desired to record seismic waves propagated to the surface at an angle to the vertical and to eliminate waves propagated to the surface at a different angle, which comprises positioning a pair of seismic wave detectors in separated relation at the earth's surface, generating seismic waves at a point on the earth's surface, recording the outputs of said detectors in the form of parallel opaque tracks on a moving film, the width of each track indicating the output of a detector at any instant, subsequently converting said tracks to electrical currents having amplitudes corresponding to a characteristic of said tracks, and measuring the difference in said currents. Claims allowed, 5.

11878. Electromechanical transducer. Alfred L. W. Williams, Cleveland Heights, Ohio, assignor to the Brush Development Co., Cleveland, Ohio, a corporation of Ohio: U. S. patent 2,497,108, issued February 14, 1950.

An electromechanical transducer comprising: an elongated element of electromechanically sensitive dielectric material convoluted into a space the largest dimension of which is a small fraction of the length measured along said elongated element to provide an electromechanical response significantly greater than that of an element of the same material and cross-sectional shape having a length equal to said largest dimension but having a straight configuration. Claims allowed, 14.

11879. Electromechanical transducer. Charles Revell Holden, deceased, late of Altadena, Calif., by Cora E. Holden, executrix, Altadena, Calif., assignor to William H. T. Holden, New York, N. Y.: U. S. patent 2,498,737, issued February 28, 1950.

In a piezo-electric transducer, a metallic housing comprising two sections, a plate of piezo-electric material yieldingly clamped between said sections, annular grooves on both sides of said plate circumscribing a central area thereof and increasing the freedom of movement of said central area with respect to the remainder of said plate, a plurality of disc-shaped piezo-electric members of substantially identical dimensions and piezo-electric properties stacked upon each other and in contact with one side of said circumscribed area of said plate, a terminating piezo-electric disc in contact with said stack of discs of substantially the same diameter and piezo-electric properties, but one half the thickness of said first-named discs, an electrically conducting coating completely surrounding said terminating disc, an electrode yieldingly engaging said conducting coating, a source of high-frequency energy having two terminals, conductors connecting one of said terminals to said electrode and the other of said terminals to said metallic housing, means for circulating an electric conductive cooling and insulating fluid in and about the section of said housing containing said discs, and means for circulating a fluid to be treated in and about the other section of said housing. Claims allowed, 36.

11880. Coupling means for seismometers. Floyd J. Williams, Dallas, Tex., assignor to Geophysical Service, Inc., Dallas, Tex., a corporation of Delaware: U. S. patent 2,501,558, issued March 21, 1950.

A seismometer including a transformer core at least part of which lies outside of the seismometer case, a winding on the transformer core connected to receive electrical signals from the seismometer, and a removable portion in the transformer core outside of the seismometer case and adapted to be removed and replaced to permit the insertion and removal of a secondary winding on the transformer core. Claims allowed, 4.

RADIOACTIVE METHODS

11881. Method and apparatus for producing neutrons. Winfield W. Salisbury, Cedar Rapids, Iowa, assignor to Collins Radio Co., Cedar Rapids, Iowa, a corporation of Iowa: U. S. patent 2,489,436, issued November 29, 1949.

Apparatus for generating neutrons comprising, an evacuated receptacle having a wall portion thereof formed of a metal which when heated is pervious to deuterium, means to apply deuterium to the surface of said wall portion which is external to said receptacle, means to heat said wall portion to render it pervious and to cause said deuterium to appear at the surface of said wall portion which is interior of said receptacle, and an electrode system within said receptacle for ionizing deuterium which seeps through said wall portion and for accelerating the deuterium ions into high velocity collision with said deuterium and thereby to produce neutrons. Claims allowed, 15.

11882. Radiation counter tube. Frank E. Dudley, Philadelphia, Pa.: U. S. patent 2,489,627, issued November 29, 1949.

In a radiation counter tube, a tubular electrode having internal equidistant spaced longitudinal ribs of arcuate cross section, a central electrode extending longitudinally through the tubular electrode and an envelope surrounding the electrodes. Claims allowed, 6.

11883. Radiation detecting apparatus. Albert Ghiorso, Berkeley, Calif., and Carroll M. Gordon, San Pablo, Calif., assignors to the United States of America as represented by the United States Atomic Energy Commission: U. S. patent 2,490,298, issued December 6, 1949.

In combination, radiation detecting means including an electrode, a stationary chamber, a plate detachably affixed to said chamber and adapted to support said means as a unit, thereby to position the electrode within said chamber, gas supply means connected to said chamber, a material transfer compartment spaced from said chamber, a passageway connecting said chamber and compartment, a movable sealing member adapted to establish a seal between said compartment and said passageway and a movable cover for said compartment. Claims allowed, 16.

11884. Voltage control and stabilizing circuits. Gerhard Herzog, Houston, Tex., assignor to The Texas Co., New York, N. Y., a corporation of Delaware: U. S. patent 2,493,535, issued January 3, 1950.

The method of detecting radiation wherein an instrument capable of detecting radiations encounters regions of varying temperature which comprises impressing a direct current potential on an electrode of a radiation detector of the counter type to yield current pulses, as a result of radiations, and varying the potential impressed on the electrodes of said detector directly as a function of the temperature encountered by said detector, thereby maintaining detector in effective operating condition. Claims allowed, 4.

11885. Radiation counter. Herbert L. Anderson, Hartford, Conn., and Philip G. Koontz, Fort Collins, Colo., assignors to the United States of America as represented by the United States Atomic Energy Commission: U. S. patent 2,494,641, issued January 17, 1950.

A device for indicating the intensity of beta rays, comprising a cathode in the form of a thin walled envelope of material of low absorption for beta rays, and of uniform outer thickness and uniform diameter throughout substantially its entire length, and an anode and ionizable medium contained in said envelope, wherein the cathode is a unitary cup-shaped member having a thickened wall portion adjacent to the closed end thereof. Claims allowed, 16.

11886. Coincidence proportional counter. John Morris Blair, Stillwater, Okla., and James M. Hush, Lincoln, Nebr., assignors to the United States of America as represented by the United States Atomic Energy Commission: U. S. patent 2,495,650, issued January 24, 1950.

Apparatus of the kind described comprising a gas-filled chamber, hydrogenous material in said chamber from which to produce recoil protons, and two aligned counter ionization units spaced from and in line with said hydrogenous material, said units being connected into a coincidence circuit so that only pulses originating from ionization in both units at the same time are counted. Claims allowed, 16.

11887. Radiation alarm and measurement device. Everett W. Molloy, Pasadena, Calif., and William W. Hinch, Denver, Colo., assignors to the United States of America as represented by the United States Atomic Energy Commission: U. S. patent 2,496,886, issued February 7, 1950.

Apparatus for the detection and measurement of radioactivity comprising, in combination, an ionization chamber circuit adapted to produce a direct voltage proportional to the radioactivity under measurement, an electronic tube having a control-grid connected to the positive ion collector of the ionization chamber, a cathode and a plate, a plate load resistor connecting said plate to a source of plate supply voltage, a resistor and a glow discharge tube connected in series, with each other and in parallel with at least a portion of said plate load resistor, a condenser connected in parallel with said glow-discharge tube, a calibrated variable direct voltage source connected in series opposing with said direct voltage produced by said ionization chamber circuit, and means for impressing the resultant net voltage of said series combination of direct voltage sources between the control-grid and cathode of said electronic tube. Claims allowed, 9.

11888. Radiation detecting apparatus. Max D. Liston, Wilton, Conn., assignor to The Perkin-Elmer Corp., Glenbrook, Conn., a corporation of New York: U. S. patent 2,497,129, issued February 14, 1950.

In a detecting means, the combination of a source of rays, an element receiving rays from the source and generating a voltage in response thereto, a member interposed between the source and the element and operating to intercept the rays at a low and uniform frequency, an interrupter in circuit with the element and periodically interrupting the current produced by the voltage generated by the element, means receiving the interrupted current and amplifying it, a rectifying device receiving the output from the amplifying means and operating in timed relation to the interrupter to cause the voltage generated by the element to be reproduced although amplified, a second rectifying device directly receiving substantially the entire unaltered output of the first rectifying device and operating in timed relation with and at the same frequency as the member to cause the voltage generated by the element in response to the rays to produce a direct current output, and filter means connected to and receiving the entire output of the second rectifying device and passing said direct current output only. Claims allowed, 6.

11889. Detector for high energy radiation. Albert M. Skellett, Madison, N. J., assignor to National Union Radio Corp., Orange, N. J., a corporation of Delaware: U. S. patent 2,498,461, issued February 21, 1950.

Apparatus for detecting high energy radiation arising from an external source, comprising an evacuated device having a pair of conductive members defining a gap, at least one of said members having a coating of secondary electron-emissive material, means to excite said members with a high frequency voltage, at least part of the wall of said device being pervious to the said radiations from said external source to permit them to enter said gap. Claims allowed, 16.

11890. Neutron detection. Gerhard Herzog, Houston, Tex., and Kenneth C. Crumrine, Tulsa, Okla., assignors to The Texas Co., New York, N. Y., a corporation of Delaware: U. S. patent 2,499,311, issued February 28, 1950.

In neutron detection apparatus having a source of neutrons which simultaneously emits gamma rays, the combination which comprises at least two proportional counters spaced at different distances from the source, means for applying an actuating voltage across the counter near the source and means for applying a higher actuating voltage across the counter remote from the source. Claims allowed, 8.

11891. Exploring for radioactive bodies. Ladislas Goldstein and Boris Pregel, New York, N. Y., assignors to Canadian Radium & Uranium Corp., New York, N. Y., a corporation of New York: U. S. patent 2,499,489, issued March 7, 1950.

A method of detecting the presence of a mass of radio-active material which emits gamma rays and which is located sufficiently close to the surface of the earth to emit said gamma rays upwardly into the atmosphere, which consists in moving an aircraft over the region to be explored, said aircraft being thus moved at an altitude within the upward range of said gamma rays, supporting a detecting ionization chamber on said aircraft to receive said gamma rays within said ionization chamber, maintaining a gaseous filling in said detecting ionization chamber in excess of normal atmospheric pressure, maintaining a difference of potential between the wall of said detecting ionization chamber and an internal electrode thereof to extract the ions which result from said gamma ray ionization so that said ions are extracted at said wall and at said internal electrode to produce a flow of detecting ionization current between said wall and said internal electrode in a predetermined circuit relative to said internal electrode, substantially shielding said detecting ionization chamber from alpha rays, determining the stray ionization in said detecting ionization chamber which results from cosmic rays and other stray rays by determining the respective stray ionization current in said detecting ionization chamber which corresponds to the stray ionization which is produced by said stray rays, observing the increase in the flow of said detecting ionization current which is produced by the gamma ray radiation which is to be detected, said aircraft being moved at a speed which is sufficiently low in proportion to CR to produce said increase in said flow of current during a period which can be readily observed, C being the capacity between said wall of said detecting ionization chamber and said electrode, R being the resistance of the circuit in which said detecting ionization current flows. Claims allowed, 5.

11892. Linear integration meter. Gerhard Herzog, Houston, Tex., assignor to The Texas Co., New York, N. Y., a corporation of Delaware: U. S. patent 2,499,953, issued March 7, 1950.

A device for indicating the counting rate of a detector of penetrative radiation which comprises a resistance and a condenser connected in series with the output of said detector to form an integration circuit having a short time constant, a second resistance adapted to form with said condenser an integration circuit having a higher time constant, means for changing from one time constant to the other while simultaneously correcting for the leakage across said condenser, and means for measuring the voltage collected on said condenser due to the pulses of the detector, said means comprising a voltage connected so as to buck the voltage on the condenser, voltage dividing means for adjusting said bucking voltage to balance the condenser voltage and means for indicating the amount of adjustment of said voltage dividing means necessary to balance the condenser voltage. Claims allowed, 3.

11893. Geiger-Mueller counter structure. Herbert Friedman, Arlington, Va.: U. S. patent 2,500,941, issued March 21, 1950.

A detecting element for a radiographic exposure meter comprising, a Geiger-Mueller counter having a coaxial anode and a cathode, an envelope therefor, and a gaseous filling of substantial pressure therein, said cathode having an active surface containing a photosensitive silver halide. Claims allowed, 7.

11894. Method and apparatus for measuring radiation. Marcel J. E. Golay, Long Branch, N. J.: U. S. patent 2,502,319, issued March 28, 1950.

The method of measuring radiation with the substantial elimination of drift which comprises periodically interrupting the radiation to be measured, producing a fluctuating radiation voltage, the amplitude of fluctuation of which is caused by and is a function of said interrupted radiation, interrupting a fixed beam of radiation in time relationship with the interruptions of said radiation to be measured, producing a synchronizing fluctuating voltage having a substantially constant amplitude of fluctuation and having its phase determined by the interruptions of said fixed beam, superposing said fluctuating radiation voltage on said synchronizing voltage and rectifying said superposed voltages to produce a direct electrical current providing a measure of said radiation. Claims allowed, 21.

11895. Geiger-Müller counter for radioactive emission. Lewis Malter, Princeton, N. J., assignor to Radio Corp. of America, a corporation of Delaware: U. S. patent 2,502,331, issued March 28, 1950.

The method of eliminating spurious counts by a Geiger-Müller counter tube which tube includes an anode and a cathode, comprising: the applying of heat to said cathode in an amount sufficient to reduce the internal tube impedance substantially and in an amount less than results in substantial cathode thermal electron emission. Claims allowed, 7.

WELL LOGGING

11896. Methods of and apparatus for transmitting intelligence to the surface from well bores. Ralph W. Goble, Denver, Colo., and Gordon Jackson, Long Beach, Calif., assignors, by direct and mesne assignments, to Eastman Oil Well Survey Co., Dallas, Tex., and Denver, Colo., a corporation of Delaware: U. S. patent 2,492,794, issued December 27, 1949.

An apparatus adapted to be lowered into a well bore for signalling to the surface the attainment of a predetermined compass position of an element within said well bore including, a metallic conductor extending through said bore, an electrical switch unit including a metallic housing attached to said conductor and having fixed circuit closing contacts which are normally in electrical disengagement and which are movable circumferentially within said bore when the conductor is rotated, said switch unit also having a gravity responsive movable contact member adapted to engage the fixed contacts to close the circuit therebetween when said contacts move into alignment with said gravity responsive contact member, whereby said circuit is closed when the fixed contacts assume a predetermined known compass position, a radio frequency transmitter mounted within the metallic housing electrically connected to said switch unit and actuated when the contacts of said switch are in circuit closing position to transmit radio waves of a fixed frequency, whereby said transmitter is operated only when the fixed contacts of the switch unit are in a known predetermined compass position, and means for coupling the transmitter to the metallic conductor to impress the radio frequency waves on said conductor so that said waves are guided by the conductor and transmitted to the surface thereby and also whereby absorption of the radio frequency electrical energy by the surrounding earth is reduced, said coupling means comprising a longitudinal supporting member of electrical insulating material secured to the lower portion of the metallic housing, an electrical conductor extending longitudinally through the support and having one end electrically connected to the transmitter with its opposite end extending outwardly along the exterior surface of the member and with the extremity thereof electrically connected to the metallic housing within which the transmitter is mounted. Claims allowed, 11.

11897. Well logging detector calibration. Gerhard Herzog, Houston, Tex. assignor to The Texas Co., New York, N. Y., a corporation of Delaware: U. S. patent 2,493,346, issued January 3, 1950.

The method of logging a bore hole which comprises passing through said hole means for detecting variations in the natural gamma radioactivity of the formations surrounding said hole, continuously measuring in the close vicinity of said detecting means direct radiation from a radioactive source passed through the hole with said detecting means, and noting variations in the measurements of the radioactivity from said source caused by changes in a characteristic of said hole. Claims allowed, 11.

11898. Voltage control and stabilizing circuits. Gerhard Herzog, Houston, Tex., assignor to The Texas Co., New York, N. Y., a corporation of Delaware: U. S. patent 2,493,536, issued January 3, 1950.

In apparatus for radioactivity well logging, an instrument housing containing a radiation detector of the counter type, a voltage divider and means for supplying a high direct current potential thereto, a tap on said voltage divider connected to an electrode of said detector, and means for varying the ratio of resistances in said voltage divider with changes in temperature whereby the potential applied to the detector electrode is varied to maintain effective operating conditions at varying temperatures. Claims allowed, 5.

11899. Apparatus for logging wells in terms of drilling rates. John T. Hayward, Solomons, Md.: U. S. patent 2,494,092, issued January 10, 1950.

In the system of rotary drilling of a well employing a rotating drilling string having a drilling tool attached to the lower end thereof and a feed mechanism attached to the upper end thereof for advancing said drilling tool through earth formations by a plurality of intermittent advancing movements at varying rates, apparatus for logging the well in terms of the average drilling rate, comprising, a record-receiving means driven by said feed mechanism in synchronism with the progressive advance of said drilling tool, an averaging device having means responsive to said drill feeding movements and to the related rotational movements of said drilling string to thereby continuously produce an output corresponding to an average of the rates of said drill feeding movements over successive drilling intervals, and means for recording said output on said record-receiving means. Claims allowed, 5.

11900. Apparatus for perforating well casings and well walls. Morris Muskat, Oakmont, and Floyd W. Parker and William L. Kehl, Penn Township, Allegheny County, Pa., assignors to Gulf Research & Development Co., Pittsburgh, Pa., a corporation of Delaware: U. S. patent 2,494,256, issued January 10, 1950.

Apparatus for shooting holes in a well pipe or well wall comprising an explosive charge having a cavity facing the wall of the well, the length of said explosive charge being in the range 1½ to 3 times its diameter, means for supporting and positioning the charge with respect to the well wall and means for initiating the detonation of the explosive charge. Claims allowed, 21.

11901. Core barrel. Benjamin W. Sewell, Tulsa, Okla., assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,494,363, issued January 10, 1950.

A pressure retaining coring assembly to recover a core on the surface of the ground at the same pressure the core left the formation, comprising a string of drill tubing, a core barrel adapted to be lowered into and raised completely out of the string of drill tubing during normal drilling operations, a bit having a passage in the center thereof attached to the end of the drill tubing to cut a core, the core when cut passing upwardly through the passage in the bit and into the lower end of the core barrel, a valve means arranged adjacent the lower end of the core barrel adapted when open to pass said core barrel and when closed to seal the lower end of said core barrel, said core barrel passing through said valve during the coring operation, and means carried by said core barrel for breaking off the core below said valve at the end of said coring operation. Claims allowed, 4.

11902. Side wall sample taker. Neville B. Brimble, Houston, Tex.: U. S. patent 2,495,439, issued January 24, 1950.

A sample taking device comprising an anchor having means thereon engageable with the walls of a well bore to support the anchor therein, a deflector connected to the anchor and downwardly movable relative thereto, said deflector and anchor being provided one with a diagonal slot and the other with a cross pin movable in the slot and forming means for moving the deflector laterally relative to the anchor, and adjacent one side of the bore, upon such downward movement, a core forming tool containing a sample chamber and having a universal connection with the deflector and arranged to be deflected by said deflector into said side of the bore and means having a universal connection with the tool for rotating said tool to form a core from said side wall. Claims allowed, 3.

11903. Radiant energy activation. Shelly Krasnow, Arlington County, Va., and Leon F. Curtiss, Montgomery County, Md., assignors, by mesne assignments, to said Krasnow: U. S. patent 2,495,736, issued January 31, 1950.

In a method for indicating conditions within a borehole, the steps of introducing radioactive material in such manner that the said material is retained within the borehole, and of subsequently measuring the radioactive intensity at different portions of the borehole, the measurement so obtained indicating the locality of the material retained, the locality of the said material serving to indicate conditions within the borehole. Claims allowed, 11.

11904. Shield for well logging instruments. Daniel Silverman, Tulsa, Okla., assignor to Stanolind Oil and Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,495,781, issued January 31, 1950.

In apparatus for logging wells including an elongated instrument housing containing an irradiation source emitting penetrating nuclear radiations, the improvement comprising a separable cylindrical shield of a radiation-absorbing substance adapted to surround the exterior of said housing, and interengaging projections on said housing and shield for positioning said shield on said housing adjacent and surrounding said irradiation source as said housing is raised through said shield. Claims allowed, 5.

11905. Geometrical determination of dip and strike of cored strata. Philip Subkow, Los Angeles, Calif.: U. S. patent, 2,496,422, issued February 7, 1950.

A method for determining the dip of strata, which comprises taking a plurality of differently deviated cores from the same or substantially parallel strata, determining the inclination and direction of the axes of such cores as taken, establishing the apparent angle of dip of the core strata in each of said cores, establishing the axes of said cores in space in the said direction and at the said inclination, determining the angle of dip of said core strata for various bearings of the dip of the core strata when said core strata are rotated about the axis of their respective cores when so directed and inclined, establishing the bearing and angle of dip of each of said core strata at which said angle and bearing of dip of each of said core strata are equal, and thus determining the bearing and angle of dip of the strata from which the cores are taken. Claims allowed, 12.

11906. Apparatus for logging boreholes. Theodore A. Huber and George E. Cannon, Houston, Tex., assignors, by mesne assignments, to Standard Oil Development Co., Elizabeth, N. J., a corporation of Delaware: U. S. patent 2,497,990, issued February 21, 1950.

An apparatus for determining the thickness of a mud sheath deposited on a portion of the wall of a borehole penetrating subsurface formations, comprising a body adapted to be lowered into the borehole, a first pair of spaced arms pivotally mounted on said body and presenting a knife edge capable of penetrating the mud sheath, biasing means arranged to bias the arms outwardly to force said arms through the mud sheath and into contact with the faces of the formations penetrated by the borehole, a second pair of spaced arms pivotally mounted on said body and presenting a surface area incapable of penetrating the mud sheath, biasing means arranged to bias outwardly the said second pair of arms and maintain them in contact with the exposed face of the mud sheath, a first indicating system operatively connected with the first pair of arms for producing an indication which is a function of the lateral extension of the first pair of arms and hence the true diameter of the borehole and a second indicating system operatively connected with the second pair of arms for producing an indication which is a function of the lateral extension of the second pair of arms and hence the apparent diameter of the borehole. Claims allowed, 1.

11907. Electrical well logging system. Philip W. Martin, Huntington Park, Calif.: U. S. patent 2,501,953, issued March 28, 1950.

In a system having a part lowerable into a well and connected with the surface by a circuit for obtaining information of conditions, the combination of: means at the surface of the ground for transmitting a lower frequency electrical current and a higher frequency electrical current through said circuit to the locality of the part in the well; modulator means carried by said part in the well responsive to two different conditions for utilizing said lower frequency current to modulate said higher frequency current in accordance with said conditions, said modulator means having a first portion responsive only to positive portions of a wave of said lower frequency current as modified by the first condition to be measured, and a second portion responsive only to negative portions of said wave as modified by the second condition to be measured; and means operatively connected to said circuit at the surface, said means operating in synchronism with said lower frequency current to segregate and separately indicate the respective values imposed on said higher frequency current by said modified positive and negative portions of said wave. Claims allowed, 3.

INDEX

	Abstract
Agamennone, Giovanni	11717
Agnich, F. J	11829
Ahrens, Louis	11759
Akademii͡a Nauk	11694
Aliverti, Giuseppina	11841
Alldredge, L. R	11808, 11812
Anderson, H. L	11885
Aslakson, C. I	11858
Bachinskii, N. M	11743
Bailey, F. G	11783
Baker, J. S	11844
Balsley, J. R	11813
Barbosa Braga, E	11802
Bath, Markus	11718, 11737
Belluigi, Arnoldo	11831
Benfield, A. E	11767
Benioff, Hugo	11735
Bernholtz, Ben	11832
Berson, I. S	11821
Blair, J. M	11886
Bossolasco, Mario	11701
Bourret, Weston	11814
Bowen, W. R., Jr	11698
Brimble, Neville	11902
Broding, R. P	11863
Brown, Hart	11804
Browne, B. C	11784
Bruckshaw, J. M	11785
Bush, R. E	11850, 11851
Byerly, Perry	11716
Cagniard, Louis	11690
Calhoun, J. C., Jr	11835
Campbell, J. L. P	11851, 11852
Cannon, G. E	11906
Carlson, R. F	11856
Carr, D. R	11758
Carreño, Alfonso de la O	11803
Cook, A. H	11692
Cox, Harris	11791
Cumming, J. L	11792
Curtiss, L. F	11747, 11748, 11749, 11903
Crumrine, K. C	11890
Darling, F. W	11680
Davis, G. L	11764
Deegan, C. J	11866
Delaney, C. F. G	11753
Dessau, G	11798
DeVilliers, John	11796
d'Henry, G	11740
Dichtel, W. J	11812
DiFilippo, Domenico	11719
Dixey, F	11794
Doll, H. G	11843
Dudley, F. E	11882
Eby, J. B	11786
Eckhardt, E. A	11787
Egyed, László	11684
Escher, B. G	11770
Evans, R. D	11748
Ewing, Maurice	11729, 11730, 11782
Faul, Henry	11848, 11849
Fiano, R. G	11830
Frank, Marco	11867
Friedman, Herbert	11893
Fritsch, Volker	11839
Garcia Rojas, Antonio	11800
Garcia Siñeriz, José	11805
Geologisches Landesamt	11779
Ghiorsi, Albert	11883
Gilbert, R. L. G	11681
Gilchrist, Lachlan	11832
Goble, R. W	11896
Golay, M. J. E	11894
Goldstein, Ladislas	11891
Good, S. E	11820
Goodman, Clark	11848, 11849
Gordon, C. M	11883
Goudey, Raoul	11690
Gough, D. I	11697
Graham, J. W	11703
Greenman, W. G	11793
Guseman, L. F	11827
Gutenberg, Beno	11727, 11728
Hales, A. L	11697
Halliday, D. J	11859
Hamilton, G. R	11730
Handley, A. J	11823
Hasbrook, A. E	11876
Haskell, N. A	11862
Hawkins, J. E	11874
Hayes, R. C	11721
Hayward, L. T	11899
Henderson, R. G	11806, 11807
Herrick, H. N	11870
Hersey, J. B	11730
Herzog, Gerhard	11884, 11890, 11892, 11897, 11898
Hess, H. H	11764
Hill, M. N	11731
Hinch, W. W	11887
Hine, G. H	11750
Hirano, Kintaro	11713
Hofmann, Walter	11685
Holden, C. R	11879
Holland, H. D	11755
Howell, B. F., Jr	11822
Huber, T. A	11906
Huntington, H. B	11711
Hurley, P. M	11760, 11763, 11765, 11815

Abstract
Hush, J. E. 11886

Inglada Ors, Vicente 11720
Ising, Gustaf 11682

Jackson, Gordon 11896
James, H. L. 11813
Jardetzky, Wietcheslaw 11768
Jelstrup, G 11683
Johnson, Warren 11748
Jones, L 11691
Joubin, F. R 11795
Jurney, E. T 11752

Kehl, W. L 11900
Kimura, Kiichi 11751, 11756
Konakhovich, I͡U. I͡A 11695
Koontz, P. G 11885
Krasnow, Shelley 11903
Kruger, F. C 11836
Kuhn, Werner 11736
Kulp, J. L 11755, 11758

Lacy, W. C 11836
Lapwood, E. R 11709
Latyshev, G. D 11695
Leet, L. D 11704, 11738, 11739
Legrand, J. C 11843
Lemcke, Kurt 11722
Lipskai͡a, N. V 11833
Liston, M. D 11888
Lozano Calvo, Luis 11679
Lundberg, Hans 11810

McCaslin, L. S., Jr 11799
McComb, H. E 11715
McCormick, R. C 11753
McKim, V. C 11706
McKinney, R. U 11871
Maecker, H 11712
Maienschein, Fred 11752
Malter, Lewis 11895
Maple, E 11698
Marble, J. P 11761
Marcuse, H 11842
Martin, P. W 11907
Medvedev, S. V 11744
Mei, A. I 11716
Mercier, V. J 11846, 11853
Merten, Eugene 11872
Metzger, A. A. T 11837
Milne, W. G 11705
Mintrop, Ludger 11788
Molloy, E. W 11887
Montandon, Frederic 11724
Morelli, Carlo 11688, 11689, 11732, 11740, 11762
Mott, P. G 11860
Murphy, Thomas 11703
Muskat, Morris 11900

Nagata, Takeshi 11725
Nel, L. T 11796
Neumann, Frank 11715
Nichols, P. B 11857
Nicolson, A. M 11873
Norelius, R. G 11844, 11854

Abstract
Oil 11809
Oszlaczky, Szilárd 11686
Oulianoff, Nicolas 11726, 11774

Parker, F. W 11900
Perret, W. R 11838
Petroleo Interamericano 11824
Petroleum 11811
Petroleum World 11828
Petrova, G. N 11696
Petrucci, G 11834
Pettersson, Hans 11781
Pettijohn, F. J 11820
Picciotto, Edgard 11754
Poole, J. H. J 11753
Powell, C 11864
Pregel, Boris 11891
Press, Frank 11730
Price, W. J 11711

Raitt, R. W 11733
Ramirez, J. E 11707
Reich, H 11777, 11780
Riznichenko, I͡U. V 11710
Roche, Alexandre 11702
Romberg, Frederick 11801
Romney, Carl 11716
Rooney, W. J 11745
Rostoker, Normon 11832
Rouaud, Andre 11714
Roubault, Marcel 11772
Rubenstein, J. H 11869
Ruge, A. C 11715
Rumbaugh, L. H 11808
Rutten, L. M. R 11773

Salisbury, W. W 11881
Schaufelberger, W. M 11870
Schmidt, E. R 11771
Seaborg, G. T 11748
Sewell, B. W 11901
Shimek, E. J 11875
Silverman, Daniel 11904
Simpson, D. J 11796
Singer, S. F 11698
Skellett, A. M 11889
Slack, H. A 11766
Slaucitajs, Leonīds 11700
Stein, J. H 11868
Stick, J. C., Jr 11844
Stratton, E. F 11843
Stripling, A. A 11863
Subkow, Philip 11905
Sullivan, C. J 11797
Swallow, J. C 11731

Takahashi, Ryutaro 11713
Takubo, Jitsutaro 11746
Tarczy-Hornoch, A 11687
Texas Oil Journal 11825
Thirlaway, H. I. S 11692
Thommeret, J 11757
Tillotson, Ernest 11708
Tiratsoo, E. N 11847
Tittle, C. W 11848, 11849
Tolstoy, Ivan 11782

Abstract
Torreson, O. W 11703
Trefethen, J. M 11789
Tschu, K. K 11699
Tsimbalin, V. V 11695

Uemura, Yoshiaki 11751
U. S. Geological Survey 11816, 11817, 11818

Valle, P. E 11723

Wanner, E 11742
Wasiutynski, Jeremi 11769
Weiss, Oscar 11819
Western Miner 11840, 11861
Wier, K. L 11813
Wijk, A. M. van 11697
Wilhelm, E. S 11863
Williams, A. L. W 11878

Abstract
Williams, F. J 11880
Willmore, P. L 11734
Wilson, B. T 11810
Wilson, J. Tuzo 11776
Winter, A. B 11852
Wolf, Alexander 11877
Woodward, M. E 11855
Woollard, G. P 11693, 11775
World Petroleum 11826, 11865
Worzel, J. L 11730
Wyllie, M. R. J 11845

Yale, M. V 11790

Zanon, F. S 11741
Zietz, Isidore 11806, 11807
Zwerger, Rudolph von 11778

Geophysical Abstracts 141 April-June 1950

Numbers 11908-12125

GEOLOGICAL SURVEY BULLETIN 976-B

Geophysical Abstracts 141 April-June 1950

(Numbers 11908–12125)

y MARY C. RABBITT, *and* S. T. VESSELOWSKY

EOLOGICAL SURVEY BULLETIN 976-B

bstracts of world literature
ontained in periodicals,
ooks, and patents

DEPARTMENT OF THE INTERIOR
March 3, 1849

NITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1950

UNITED STATES DEPARTMENT OF THE INTERIOR

Oscar L. Chapman, *Secretary*

GEOLOGICAL SURVEY

W. E. Wrather, *Director*

The printing of this publication has been approved by the Director of the Bureau of the Budget, February 1948

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price 25 cents (paper cover). The printing of this publication has been approved by the Director of the Bureau of the Budget, February 1948.

CONTENTS

Page
Introduction ---- 71
Earth physics ---- 73
  Gravity ---- 73
  Magnetism ---- 82
  Seismology ---- 84
  Electricity ---- 90
  Radioactivity ---- 90
  Heat ---- 92
  Volcanology ---- 92
  Tectonophysics ---- 94
  Internal constitution ---- 94
Exploration geophysics ---- 97
  General ---- 97
  Gravimetric methods ---- 100
  Magnetic methods ---- 101
  Seismic methods ---- 103
  Electrical methods ---- 110
  Radioactive methods ---- 115
  Well logging ---- 117
  Technical aids ---- 119
Patents ---- 120
  Gravity methods ---- 120
  Magnetic methods ---- 120
  Seismic methods ---- 121
  Electrical methods ---- 122
  Radioactive and thermal methods ---- 122
  Well logging ---- 127
  Technical aids ---- 130
Index ---- 137

GEOPHYSICAL ABSTRACTS 141, APRIL–JUNE 1950

By MARY C. RABBITT and S. T. VESSELOWSKY

INTRODUCTION

Geophysical Abstracts are prepared by the Geophysics Branch of the Geological Survey, United States Department of the Interior, as an aid to those engaged in geophysical research and exploration. Periodicals, books, and patents are regularly searched for material dealing with geophysical exploration and with basic earth physics as represented by the fields of gravity, magnetism, electricity, seismology, radioactivity, and heat.

Abstracts in this issue have been grouped in three sections dealing with earth physics, exploration geophysics, and patents. The first section has been further divided into sections on gravity, magnetism, seismology, electricity, radioactivity, heat, volcanology, tectonophysics, and the internal constitution of the earth. The section on exploration geophysics covers gravimetric, magnetic, seismic, electric, and radioactive methods, well logging, and technical aids. Within each group the order of the abstracts is as follows: general papers, bibliographies, and reviews; theory; instruments; methods and techniques; observations.

As many readers may not have ready access to the source material, an effort is made to include all significant new material in these abstracts. Where geographic names quoted differ from the decisions of the United States Board on Geographical Names the latter are added in brackets.

Geophysical Abstracts 1–86 and 112–127 were issued as Information Circulars by the Bureau of Mines, and 87–111 were issued as Bulletins of the Geological Survey. Beginning with 128, Geophysical Abstracts are published as Bulletins of the Geological Survey.

As long as available, Geophysical Abstracts 124–127 may be obtained free of charge from the Publication Distribution Section of the Bureau of Mines. All others are now out of print. Geophysical Abstracts issued as Bulletins of the Geological Survey (except Nos. 87 and 88 which are out of print) may be purchased as single copies or by subscription from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. For subscription, the Superintendent will accept a deposit of $5 in payment for subsequent issues. When this fund is near depletion, the subscriber will be notified. The deposit may also be used to purchase any other publication from the Superintendent of Documents.

Acknowledgments.—Special thanks are due Roland G. Henderson, H. R. Joesting, and Isidore Zietz who have prepared the abstracts signed R. G. H., H. R. J., and I. Z., and Dr. Kumizi Iida of the Geological Survey of Japan who has furnished material from which the abstracts of articles in Geophysical Exploration were made.

EARTH PHYSICS

GRAVITY

11908. Cole, J. H. Geodesy in Egypt. Ministry of Finance, Egypt. Survey Department, 163 pp., 1944.

The history of geodetic work in Egypt from its beginning in 1907 to recent time is summarized. A report on gravity measurements is included.

The first accurate determinations of gravity were made in 1908 at Helwan Observatory and seven other stations using a Stuckrath pendulum apparatus. Since 1927, when a similar apparatus was acquired by the Egyptian Government, the network of gravity stations has been extended and many measurements repeated. The most recent determination gave for Helwan Observatory g=979.288 gal.—*S. T. V.*

11909. Baars, B. Getijden-veranderingen van de zwaartekracht [Tidal variations of the force of gravity]: Geol. en Mijnb., vol. 12, no. 3, pp. 81–88, 1950.

Recent improvements in the design and construction of gravimeters have made possible an accuracy of 0.01–0.02 mgal. in determination of the force of gravity, and have led to the discovery of periodic variations of this force caused by the sun and the moon. In 1948 a program was organized by B. P. M. to measure accurately the gravity force at 20 to 25 places on the earth's surface. These determinations were to be continuously registered between May 9 and May 23, 1949. The data obtained should aid in an accurate determination of the elastic properties of the earth.—*S. T. V.*

11910. Lagerquist, P. A. Einige Experimentaluntersuchungen zur Gravimetrie [Experimental investigations on gravimetry]: K. svenska vetensk. Arkiv mat., astron. fys., Band 36A, no. 12, 25 pp., 1949.

Investigations of the use of capillary rise of liquids for measuring gravity, as suggested by G. Ising (*see* Geophys. Abstract 11682) are described. Temperature variations of 0.01° C. were found to produce a change in the reading corresponding to a gravity change of 40 mgal. It was also found that unless the inner diameter of the capillary tube is strictly invariable, variation of the wetted perimeter of the meniscus produces a change in gravity readings. Deviation of the tube from the vertical must also be considered.

Petroleum was found to be the most suitable liquid. By adjusting the total volume of petroleum in the special-shaped container in relation to the diameter of the tube, it was possible to reduce the influence of the temperature variation to 20 mgal. per degree centigrade. The temperature of the instrument was kept constant by a double-walled housing filled with ice, and the position of the meniscus was observed through a miscroscope. The aging of the glass, combined with the change of the volume of the petroleum bulb, caused a slow drift of the instrument, which may be eliminated or substantially reduced by appropriate heat treatment.

In its final shape the new gravimeter was tested both in the laboratory and outdoors and the error of an individual reading was ±0.2 mgal.

The instrument is adaptable to use on board ship and probably in an airplane. Experimental observations on a small moving cutter showed that the error in an average reading is not greater than ±3 mgal. and may be further reduced.

Experiments indicated good temperature compensation of an instrument similar to the Thyssen gravimeter, could be achieved by making the spring system partly of quartz, with a positive thermal coefficient, and partly of beryllium-copper alloy, with a negative thermal coefficient. Promising results were shown in experiments to provide temperature compensation of horizontal pendulum instruments as the Ising or Mott-Smith gravimeters by combining different materials in the spring system, by designing the moving system of the instrument so that it is affected by temperature variation in a direction opposite to that of the spring system.—*S. T. V.*

11911. Volet, Charles. La medida de la gravedad [The measurement of gravity]: Rev. Geofís., vol. 8, no. 32, pp. 533–544, 1949.

A new method of measuring the force of gravity is suggested. It consists in observation of the vertical trajectory of a body falling in vacuum. The trajectory is cinematographically recorded over a length of about 1.25 m. with highest attainable precision in time and length measurements. The error in length measurements is less than two tenths of a micron. Time measurements are made by modulation of a beam of light by a vibrating quartz crystal, with frequency of 35,000 cycles per second. The error in time measurements can be reduced to a fraction of a millisecond. Experiments with this method in the Laboratory of the International Office of Weights and Measures gave very promising results.—*S. T. V.*

11912. Cooper, R. I. B. Recent advances in the technique of submarine gravity surveying: Royal Soc. London Proc., ser. A, vol. 197, no. 1051, pp. 523–545, 1949.

The errors of gravity surveying at sea that are the most difficult to estimate are involved in position finding, measurement of speed over the ground, the variations of depth keeping and in the second-order correction. Submarine gravity surveying is also a slow process on account of the time required for an observation with the standard Vening Meinesz pendulum apparatus and the complications of computing the result. During the recent cruise in the English Channel in May 1948 of H. M. Submarine Talent most of these difficulties were overcome by the provision of special instruments that are described here. The most important of these was a stabilizer which, by automatically compensating the effect of sideways accelerations on the pendulums, removed the necessity for certain tedious corrections and enabled the results to be rapidly computed.—*Author's abstract.*

11913. Nishimura, Eiichi. On earth tides: Am. Geophys. Union Trans., vol. 31, no. 3, pp. 357–376, 1950.

The paper is divided into six sections. In the first, the effective modulus of rigidity of the earth's upper mantle (60–1,200 km.) is calculated as 6.17×10^{11} dynes/cm.^{2} By using vector differences between tiltmetric observations at two selected stations, the direct effects of earth tides are almost entirely eliminated and the oceanic effects accurately evaluated. The second section deals with motion of the earth's surface near an active fault. Anomalous tilting diagrams were recorded at six closely spaced stations in Beppu, Japan. It is found that when the alluvial plain is bent by loading of tidal sea water the fault apparently behaves like the free boundary of an elastic plate so that some points near both the fault and seashore tilt toward the fault rather than toward the bay. In the third section, tiltmeter observation at Barim [Pa-lin] in northwestern Manchuria are used to compute the effective rigidity for the mantle and the earth as 13.95 and 6.56×10^{11} dynes/cm.^{2} respectively. In the fourth section tidal latitude variations are analyzed from data recorded over long periods at six International Latitude Observatories. The mean value of the ratio of observed to theoretical tidal variations is estimated as 1.20. The fifth section discusses an unusually large variation with time in earth tidal amplitude observed at Makimine, Japan. This is considered to be closely related to bending of the earth's crust caused by the load of sea water in Hyūga-nada, an active center of large-scale earthquakes. In the last section, analysis of tiltmetric data at several Japanese stations suggests that the elasticity of the earth's upper mantle in the north-south line is 20 to 30 percent smaller than that in the east-west line.—*M. C. R.*

11914. Niskanen, Erkki. On the elastic resistance of the earth's crust. Isostatic Inst. Internat. Assoc. Geodesy Pub. 23, 23 pp., 1949. (Reprinted from the Annales Acad. Sci. Fenn., Ser. A, 3. Geol.-Geog., 21).

The uplift of land in Fennoscandia is studied assuming the earth's crust to be elastic; the subcrustal magma to be highly viscous, incompressible fluid; and the Fennoscandian basin to be caused by a uniformly thick and circular accumulation of ice. Differential equations describing the movement of an elastic medium are solved to obtain a time dependent formula for the deformation of the crust at the center of subsidence.

According to the derived formula, after the melting of the ice cap, the surface will never reach the pre-glacial level. Assuming the relatively high value of 5.4×10^{11} dyne/cm.^{2} for the modulus of rigidity, and an initial subsidence of 800 m., a deflection of about 300 m. will remain at the center. The fact that no such subsidence remains leads to the conclusion that by 6500–6000 B. C. the earth had arrived at the niveau which it could never exceed because of crustal rigidity. The later upheaval is due to slow decay of stresses in the crust. Therefore it is not possible to draw any conclusion as to the order of viscosity of the subcrustal magma from observations subsequent to 6500–6000 B. C. The upheaval prior to this date was violent according to geological facts, lending support to the belief that the viscosity is considerably less than the values calculated from the Fennoscandian uplift phenomenon.—*R. G. H.*

11915. Niskanen, Erkki. On the viscosity of the earth's interior and crust. Isostatic Inst. Internat. Assoc. Geodesy Pub. 20, 22 pp. 1948. (Reprinted from the Annales Acad. Sci. Fenn., Ser. A, 3. Geol.-Geog., 15).

The formula derived by Darwin, Chree, Lamb and others describing the reversion of a deformed globe to its original form is applied to the Fennoscandian upheaval to calculate the earth's viscosity. On the assumption that the viscosity of the earth's crust differs from that of the interior, a formula resembling Darwin's is derived which is more in keeping with the view that the viscosity is a function of the radius. When the thickness of the crust is assumed to be zero, the two formulas are identical.

For a homogeneous globe of density 2.7 gm./cm.^{3} the Darwin formula gives a viscosity of 2.4×10^{22} c. g. s. units. The modified formula gives 1.9×10^{22} c. .g. s. units for the interior and 3.8×10^{22} c. g. s. units for the crust, assuming the viscosity of the latter to be twice that of the core. The values are large, but agree with those obtained by other investigators.

It is concluded that in a multilayered earth the viscosity would diminish inwardly from layer to layer.—*R. G. H.*

11916. Tanni, L. I. On the continental undulations of the geoid as determined from the present gravity material. Isostatic Inst. Internat. Assoc. Geodesy Pub. 18, 78 pp., 1948. (Reprinted from the Annales Acad. Sci. Fenn., Ser. A, 3. Geol.-Geog., 16).

The main purpose of this publication is to show to what extent the present gravity data are adequate for the determination of the geoid. A thorough discussion is given of the factors affecting the problem.

A mathematical derivation of Stokes' formula for calculating the shape of the geoid from gravity data is given and the error introduced by the approximations involved is estimated to be ±35 cm. when N, the difference between the geoid and the reference ellipsoid, is 100 meters.

The condensation, inversion, and isostatic compensation methods of reduction are examined critically and it is concluded that complete isostatic reduction is the most suitable treatment of gravity material in geoid determinations. The Pratt-Hayford, D=113.7 km., and Airy-Heiskanen, T=60 km., hypotheses were used collaterally.

The gravity data employed consisted of several thousand gravimeter observations and records from 13,000 pendulum stations. A card index system was adopted in which the principal data of all pendulum stations of each square degree of coordinates are recorded on the same card. The distribution of measurements is irregular, and the field of square degree anomalies covers only about 8.5 percent of the globe.

The undulations of the actual geoid determined in this investigation are presented in a table and in a contour map. From the 218 points calculated the maximum and minimum values of the continental undulations are about ±60 meters and on an average about ±30 meters. In the more central areas the accuracy of the N-values obtained may be ±10 meters. The geoid sinks with a gentle slope towards the North American coast and closely coincides with the reference ellipsoid on the American continent. However, the lack of gravity observations on the Pacific Ocean makes the geoid determinations more uncertain in America than in Europe.—*R. G. H.*

11917. Tanni, L. I. The regional rise of the geoid in Central Europe. Isostatic Inst. Internat. Assoc. Geodesy Pub. 22, 18 pp., 1949. (Reprinted from the Annales Acad. Sci. Fenn., Ser. A, 3. Geol.-Geog., 20).

In a previous publication the author determines the continental undulations of the geoid using a 5° square grid. In this article the author makes use of these mean gravity anomalies and recomputes the geoid on the basis of a 1°×1° grid spacing. The method of interpolation for the change in grid size is discussed and the basic data for the reduction are made available in a table. Two maps show the compensated and the actual geoids in Central Europe. The probable accuracy of the N values (undulations) is shown to be one or two millionths of the earth's radius.

The method of calculation presented will produce a geoid of sufficient accuracy to be applicable for the reduction of the base lines of triangulation to the ellipsoid.—*I. Z.*

11918. Jeffreys, Harold. On the absolute measurement of gravity: Royal Astron. Soc. Monthly Notices Geophys. Supp., vol. 5, no. 9, pp. 398–408, 1949.

A simplified method is given for finding the corrections for bending and stretching of a pendulum used for making an absolute determination of gravity. It appears that the correction given by Clarke is incorrect and that the value of *g* for Teddington consequently needs an increase of about 1.7 mgal. Examination of several minor corrections mentioned by Heyl and Cook for the Washington determinations shows that they mount up and that the value given by these authors also needs an increase of about 1.5 mgal. When taken in conjunction with the relative determination by Bullard and Browne, the revised values give a discrepancy of 4.7±1.6 mgal., which is large enough to need attention. An independent determination is desirable.—*Author's abstract.*

11919. Hirvonen, R. A. On the establishment of the values of gravity for the national reference stations. Isostatic Inst. Internat. Assoc. Geodesy Pub. 19, 21 pp., 1948. (Reprinted from the Annales Acad. Sci. Fenn., Ser. A, 3. Geol.-Geog., 17).

In 1946, an adjustment of the gravity values for the national reference stations was made by Morelli. This paper presents a discussion of the adjustment of the same stations using different error equations, thus providing an independent check on Morelli's work. The construction of the error equations is discussed and the resulting gravity data are tabulated. Many values differ from those published by Morelli by an amount which is more than can be tolerated. Unfortunately, Paris, which is gradually replacing Potsdam as the new European center of gravity, is also so affected. The author concludes, unlike Morelli, that the present status of the gravity net is unsatisfactory for establishing standard gravity values for the reference stations. As a consequence, he emphasizes the need for more observatories rather than more elaborate adjustments.—*I. Z.*

11920. Woollard, G. P. The gravity meter as a geodetic instrument: Geophysics, vol. 15, no. 1, pp. 1–29, 1950.

A special Worden temperature-compensated gravity meter with a range of 5,500 mgal. and a reading sensitivity of 0.1 mgal. was used in tying together various primary base stations around the world and in establishing new stations. During a 3-month period, 33 pendulum stations were reoccupied, involving a maximum difference in gravity of 3,800 mgal., and 125 gravity stations were established.

The instrument proved satisfactory for long-range geodetic work and the results appear equal to good pendulum observations. Drift corrections were made on the basis of drift rates established immediately before and after plane flights to stations. Closures after correcting for drift averaged less than 0.4 mgal. and the closure for the world-girdling loop was 0.33 mgal.

Errors of approximately 5 mgal. in the pendulum determinations at Washington (Bureau of Standards) and Teddington (National Physical Laboratory) were discovered by the reoccupation. An error of 15 to 19 mgal. in the Potsdam absolute value was indicated by indirect ties through primary national gravity bases. Most of the primary national gravity bases tied directly to Potsdam agreed among themselves within 1 mgal.; the Bureau of Standards value is essentially a perfect connection with the Potsdam base. Two appendices give the principal facts and descriptions for the new stations.—*H. R. J.*

11921. Hallenbach, Franz. Die Schweydarsche Methode zur Bestimmung der Einfluss der Topographie auf den Schweregradienten (The Schweydar method of computing the topographic reduction to the gravity gradient): Beitr. angew. Geophysik, Band 10, Heft 3–4, pp. 332-342, 1943.

In computing the topographic reduction to be applied to the measurements of the gravity gradient made with torsion balance, the terrain, surrounding the point of observation, is divided into circular belts by a number of increasing radii and into sectors of different azimuths. On the basis of an accurate levelling of the region to each element a constant factor is ascribed representing its contribution to the value of the gravity gradient.

Quite often the constants obtained in such a manner show a sharp variation of their values called by German authors the "jumping of the constants".

The author recommends in computing the constants that the members with the radii Z_n, Z_{n+2}, Z_{n+4} and so on be used, and later those with Z_{n+1}, Z_{n+3}. As a result smooth curves of the constants are obtained and a precise value of the topographic reduction is obtained. The article contains tables of numerical values used in these calculations.—*S. T. V.*

11922. Heiskanen, W., and Sala, I. The topographic-isostatic reduction of gravity anomalies by the aid of small scale maps. Isostatic Inst. Internat. Assoc. Geodesy Pub. 21, 23 pp., 1949. (Reprinted from the Annales Acad. Sci. Fenn., Ser. A, 3. Geol.-Geog. 18).

The error of the topographic-isostatic reduction resulting from the use of small scale topographic maps is investigated. With the aid of maps on the scale 1:4,000,000, observations of gravity at 85 Indian, 88 American, and 16 European stations were reduced and the values compared with those previously obtained by rigorous reductions employing large scale maps. The tabulated results indicate that in spite of the small scale, the topographic-isostatic reduction in the zones *A–K* in the Hayford system can be performed with an accuracy of 5 mgal. When farther zones are taken into account the accuracy is probably 5 to 10 mgal.

Sala applied the method to 250 gravity observations in China and Indochina using the map scale 1:4,000,000. The free air and Bouguer anomalies together with the Pratt-Hayford, Airy-Heiskanen, and Vening Meinesz isostatic anomalies are tabulated and can be compared with rigorous reductions when the latter are available.

The investigation shows that in the absence of large scale maps gravity anomalies can be used, with discretion, for isostatic studies.—*R. G. H.*

11923. Magnitskii, V. A. On the isolation of the local gravity anomalies [in Russian]: Akad. Nauk SSSR Izv., Ser. geog. i geofiz., vol. 13, no. 6, pp. 556–562, 1949.

Local and regional gravity anomalies may be separated by reducing the observed total anomaly to a new, elevated surface, thus eliminating the influence of local anomalies which decrease with distance much faster than regional anomalies produced by formations of large dimensions. By applying methods developed in potential theory the gravity field can be computed for any height above the earth's surface. The method was applied to the gravity map of the Samarskaya Luka region based on a detailed survey (*See* Geophys. Abstract 9730). A new map, constructed for a level of 4 km. above the earth's surface, presented a clearer picture of the anomalies caused by deep-seated disturbing bodies and gave better information on the geological structure of the area.—*S. T. V.*

11924. Schleusener, Alfred. Genauigkeitsgrenzen bei der Bestimmung der mittleren Gesteins Dichte durch Gravimetermessungen [The limits of precision in determinations of average rock density by gravimetric measurements]: Beitr. angew. Geophysik, Band 11, Heft 1, pp. 44–54, 1944.

Determination of rock density by the gravimetric method, using measurements in drill holes along selected profiles, can be unfavorably affected by the unknown vertical gradient resulting from local anomalies. The value of this gradient is known only approximately, though usually asumed as 3086×10^{-9}. The value of g at the point of observation is known only approximately.

If the gravitational field over the surveyed area changes rapidly, the density of the ground may be measured as 2.50±0.01, when in reality it is 2.40 or 2.60. Only when the selected profile is free of important variations in the value of gravity, are the results of measurements reliable.

Mathematical deduction of the vertical gradient of gravity anomalies is based on the established network of isogams and follows the method of Evjen. Its use decreases the chief sources of errors connected with the determinations of density.

When the differences in density values obtained in different profiles are not greater than 0.04–0.07 the results can be considered reliable and their average used in calculations of the reductions.—*S. T. V.*

11925. Tsung, F. T. The average specific gravity of the geological formations in Taiwan: Chinese Geophys. Soc. Jour., vol. 1, no. 2, pp. 213–214, 1950.

In connection with gravity surveys in prospecting for oil on Taiwan, numerous density measurement of formations on the island were made, weighing the samples both in air and in water with an analytical balance. It was found that the average specific gravity of Miocene formations is greater than that of the Pliocene, and that the specific gravity of formations in the northern part of the island is much greater than those in the southern part. The density was also measured directly in place by Nettleton's method. The following average specific gravities are given: late Cenozoic coral reef limestone, 2.54; metamorphic, 2.53; igneous, 2.71; basalt, 2.67.—*S. T. V.*

11926. Cook, A. H. Values of gravity at stations in southern Britain: Royal Astron. Soc. Monthly Notices, Geophys. Supp., vol. 6, no. 1, pp. 9–27, 1950.

Gravimeter observations have been made recently in southern England by four parties: the Anglo-American Oil Co., the Anglo-Iranian Oil Co., the Department of Geodesy and Geophysics of Cambridge University, and G. P. Woollard. Calibrations of the various instruments used are discussed and the observations adjusted to obtain relative values of gravity at key stations common to two or more of the surveys. The positions of these key stations and the calculated differences of gravity between them and the Pendulum House, Cambridge, are: Teddington (N. P. L.), −72.69±0.12 mgal.; Gloucester, −41.07±0.17 mgal.; Worcester, −27.70±0.19 mgal.; Shrewsbury, 52.52±0.22 mgal. Twenty-one of the pendulum stations previously described by Bullard and Jolly have been reoccupied in gravimeter surveys. Comparisons show that the standard deviation of a single pendulum observation is 1.77 mgal. The main conclusion is that the stations in southern Britain are very well connected to Cambridge and the National Physical Laboratory, and therefore form a framework on which the existing and future gravimetric surveys may be based. Gravity differences from Cambridge, rather than actual values of gravity, are given because recent observations show that the comparisons of English and continental stations must be revised and the hitherto adopted value of gravity for Cambridge may have to be altered.—*M. C. R.*

11927. Browne, B. C., and Cooper, R. I. B. The British submarine gravity surveys of 1938 and 1946: Royal Soc. London Philos. Trans., ser. A, vol. 242, no. 847, pp. 243–310, 1950.

Gravity surveys were made at the mouth of the English Channel and from Falmouth south to the coast of Spain and west and northwest around the Hebrides and back through the Irish Sea to test the hypothesis that the edge of the continental shelf is an area of deposition and to investigate the possibility that second-order effects due to accelerations of the submarine introduce errors into gravity measurements at sea.

Three measurements were made at sea during the 1938 expedition and 51 stations at sea were occupied during the 1946 survey. The results are given in tables and charts.

The area has a mean positive anomaly but it is uncertain whether the excess mass is supported by the static strength of the crust or by a dynamic process such as convection currents. Over shallow water at the mouth of the Channel variations were of about the same magnitude as those in southwest England, but over deep water the scatter is nearly twice as great, indicating either complex structure in the basement rocks or variations of several thousand feet in the thickness of deep sea sediments. The increase in isostatic anomalies crossing the edge of the continental shelf is confirmed. A wedge-shaped layer of sediment, as indicated by seismic experiments, would explain these if the density is 2.3 and the wedge is nearly in isostatic equilibrium. Both gravitational and geologic evidence suggests the probable structure of northern Spain is a series of eastward-trending folds. The isostatic anomalies are large, indicating incomplete compensation. Positive anomalies in the Hebrides-west Scotland region increase toward the west but do not extend much beyond St. Kilda. The continuous submergence since the ice age suggested by geological evidence represents a return to isostatic equilibrium but does not explain the cause of the original excess mass.—*M. C. R.*

11928. Coron, Suzanne. La valeur de la pesanteur à Paris dans le système de Potsdam [Value of gravity at Paris in the Potsdam system]: Acad. Sci. Paris Comptes Rendus, vol. 230, no. 12, pp. 1142-1144, 1950.

Gravimetric ties since 1900 between different national base stations and either Paris or Potsdam are analyzed and the most probable value of gravity at Paris, in the Potsdam system, is derived. Hirvonen's Baltic global compensation and Schutte's compensation for central Europe were used.

Applying the method of least squares and assuming for Potsdam $g=981.2740$ gals, g at Paris was found to be 980.9435 ± 0.0003 gals if different weights were assigned to values of the ties, and 980.94335 ± 0.0004 gals, if equal weights were used.—*S. T. V.*

11929. Sans Huelin, Guillermo, and Lozano Calvo, Luis. Las determinaciones de la gravedad en España y el elipsoide terrestre más aproximado al geoide que se deduce de aquellas [Gravity determinations in Spain and the best reference ellipsoid derived from these data]: Inst. Geog. y Catastral Mem., vol. 19, no. 5, 27 pp., 1948.

At present Spain has 208 gravimetric stations on the continent and 24 on the nearby island possessions. Following the arrangement made in 1925 between the

Spanish Geographical Institute and the U. S. Coast and Geodetic Survey, isostatic reductions of the gravity data are made according to the Hayford and Bowie methods, assuming 113.7 km. as the isostatic depth of compensation.

Theoretical values of gravity are computed for the reference ellipsoids of Helmert (1901 and 1915), Bowie (1917), Cassinis (1930), and Heiskanen (1938). Results are presented in a table, indicating for each of the 208 Spanish stations its geographic position, altitude, the measured value of gravity and the theoretical values of *g* corresponding to the five reference ellipsoids, with the corresponding anomalies. Five maps of Spain showing Bouguer anomalies are included.

Gravitational anomalies in Spain confirm the Defforges rule that Bouguer anomalies are negative for inland stations, positive for islands, and oscillate around zero for coastal regions.—*S. T. V.*

11930. Sans Huelin, Guillermo, and Lozano Calvo, Luis. Red de observaciones con gravimetro en las provincia de Segovia [Network of gravimetric observations in the Provincia de Segovia]: Inst. Geog. y Catastral Mem., vol. 19, no. 2, 42 pp., 1948.

A gravimetric survey of the Provincia de Segovia, Spain, was made during 1945–46 using an Askania electromechanical gravimeter. The pendulum stations of Segovia (g=979.960 gals), C. Peñalara (g=979.773 gals), and Cercedilla (g=979.900 gals) were used as bases. One hundred forty-eight stations were occupied and 45 profiles completed.

The results of the survey are presented in two tables, indicating for each station its position, altitude, assumed density of the ground, theoretical value of gravity computed from the International formula, observed gravity value, Fayé and Bouguer corrections, and final gravitational anomaly. In an additional table the values of gravity, reduced to the geoid, are compared with the theoretical values computed for the Helmert, Bowie, Cassinis, and two Heiskanen reference ellipsoids, and anomalies are computed for each of these ellipsoids. A map of the province with stations indicated and isoanomalies traced is included.—*S. T. V.*

11931. Cunietti, Mariano. 51 misure di gravità relativa eseguite in Italia settentrionale nel 1949 [Fifty-one relative determinations of gravity in northern Italy in 1949]: Riv. Geomin., vol. 10, no. 2, pp. 37–57, 1949.

A detailed report is presented of a gravimetric survey of an area of about 30,000 sq. km. in northern Italy between the Alps and the Po River. The gravimetric station of the Polytechnic Institute of Milan (g=980.564 gals) was used as base. Results of the survey are presented in tables, giving for each station its geographic position, altitude, gravity difference compared with the base, Fayé, topographic, and Bouguer reductions, and the Bouguer anomaly. All anomalies except that at Verona were negative. The greatest anomaly was —131.4 mgal. at Tirano. An isoanomaly map of the region is included.—*S. T. V.*

11932. Lagrula, Jean. Nouvelles déterminations de l'intensité de la pesanteur en Algerie, au Maroc et au Sahara [Recent determinations of gravity in Algeria, Morocco, and the Sahara]: Acad. Sci. Paris Comptes Rendus, vol. 230, no. 16, pp. 1478–1480, 1950.

Gravity measurements were made with a Holweck-Lejay pendulum, during 1948–49 at 55 stations in an area of about 1,000,000 sq. km. in Algeria, Morocco, and the Sahara. The altitude of stations ranged from sea level to 1,640 meters.

Results are presented in a table giving for each station its geographic coordinates, altitude, observed value of gravity, the value reduced to sea level, Bouguer value, value of gravity on the International (Lambert) ellipsoid, and the Fayé and Bouguer anomalies.

La Bouzaréa, Algeria and Berrechid, French Morocco, were used as base stations.—*S. T. V.*

11933. Pacella, G. B. Determinazioni gravimetriche in Etiopia [Gravity measurements in Ethiopia]: Accad. Naz. Lincei, Cl. sci. fis., mat. e nat., Rend., vol. 4, fasc. 6, pp. 725–729, 1948.

Absolute determinations of gravity were made between 1937–41 at 14 stations in Ethiopia in the area bounded by latitude 8°54′ N. and 11°30′ N. and longitude 38°45′ and 42°48′ E. Altitude of the stations ranged from 800 to 2,900 meters above sea level.

Florence, Italy (g=980.501 gals), was selected as the base station. The results are presented in a table, giving for each station the observed values of g, the values of gravity after Fayé and Bouguer reductions, the normal gravity value and the Fayé and Bouguer anomalies. Bouguer anomalies were negative at all stations, ranging from —117 to —257 mgal.—*S. T. V.*

11934. Chao, J. S. and Tsung, F. T. The gravity measurement in Shanghai City: Chinese Geophys. Soc. Jour., vol. 1, no. 2, pp. 221–227, 1949.

A gravity survey was made over the alluvium covered area of Shanghai during the summer of 1948 using a static gravimeter of the Heiland Research Corporation with a sensitivity of 0.1 mgal. The total number of stations occupied was 163, with Zi-Ka-Wei Observatory (g=979.437 gals) as base.

For the calculation of Bouguer anomalies the average density of the ground within the range of elevation differences of the survey was assumed to be 2.2. Results of the survey are presented in a table and on a map contoured at 1-milligal intervals. The greatest anomaly found was 7.7 mgal, and the minimum —6.9 mgal.—*S. T. V.*

MAGNETISM [1]

11935. Bullard, E. C. The magnetic field within the earth: Royal Soc. London Proc., ser. A, vol. 197, no. 1051, pp. 433–453, 1949.

The paper discusses the magnetic effects of internal motions in the core of the earth. It is shown that tidal friction, fluctuations in the rate of rotation, nutation, and the variation of latitude have negligible magnetic effects. Precession is also ineffective if Poincare's theorem on the precession of a liquid sphere in a rigid shell is applicable to the earth.

Thermal convection is shown to be likely to occur in the core. The conservation of angular momentum will require it to be associated with a radial gradient of angular velocity which will have a large magnetic effect. Its interaction with the dipole field can produce a toroidal field which is many times as intense as the dipole field.

The convective and rotational motions can interact with the dipole and toroidal field in a way that tends to reproduce the dipole field. The complete theory has not been worked out, but it seems likely that the interaction is strong enough to maintain the field. The whole process resembles that occurring in a self-exciting dynamo.

The existence of a strong field in the core removes the difficulties previously found in the theory of the secular variation.—*Author's abstract.*

---

[1] See also Geophys. Abstracts 11987 and 11988.

11936. Sucksdorff, E. **Maamagnetismista ja revontulista unsien tutkimustea valossa [On geomagnetism and the aurora borealis in the light of recent research]** : Terra, vol. 59, no. 3, pp. 76–90, 1947.

Celestial bodies are assumed to be magnets. This is positively proven of the Sun, Mercury, Venus, and the Moon, where magnetism is as fundamental as gravity, and is probably being generated by the rotation of atoms and ions in the solar substance of which they are composed. The processes going on in this substance yield as the final products iron and nickel. The process is more advanced in the interior of a cooling celestial body, thus causing a greater intensity of magnetization in the interior of the planets.

If the exterior crust slowly rotates relatively to the magnetic internal core, secular variations of the internal magnetic field are produced. Variations of the external magnetic field are probably caused by the induction effect of electric currents flowing at a height of about 500 km. above the earth's surface and reaching an intensity of 120,000–260,000 amperes, along the auroral zone. Variations of the forms of the auroral zone are attributed to some unknown radiation, which also causes disturbances in the external geomagnetic field. Diagrams and pictures are added to the text and their details discussed.—*S. T. V.*

11937. Al'thausen, O. N. On certain regularities in production of thermo-remanent magnetism in magnetites [in Russian] : Akad. Nauk SSSR Izv., Ser. geog. i geofiz., vol. 13, no. 4, pp. 359–362, 1949.

The natural magnetization of many geologic formations is much greater than the magnetization produced by the local geomagnetic field. As a possible explanation the hypothesis is advanced that the present magnetic state of these formations, and primarily of their magnetite content, is one of thermo-remanent magnetism produced by the cooling of the earth and corresponding to an earlier much higher level of the geomagnetic field.

To test this hypothesis measurements were made of thermo-remanent magnetism resulting from the cooling of several magnetite samples from different ore deposits of the U. S. S. R. from a temperature above the Curie point to room temperature, while keeping them in a magnetic field. The intensity of the applied magnetic field ranged from 0 to 125 oersteds and the initial temperature was about 600° C.

It is concluded that the final magnetism of the magnetite samples is determined by the intensity of the magnetic field during the cooling. It is hoped that by reversing this relation it will be possible to estimate the intensity of the geomagnetic field of previous geological ages.—*S. T. V.*

11938. Woo, C. C. Some improvements in La Cour's quartz torsion horizontal intensity magnetometer: Chinese Geophys. Soc. Jour., vol. 1, no. 2, pp. 196–204, 1949.

On the basis of the theoretical analysis of the construction of the La Cour Q. H. M. magnetometer it is concluded that the instrument in its present form will not function properly for certain values of H, because the mechanical torque exerted on the moving system cannot be equilibrated by existing springs.

An improvement is suggested consisting of an arrangement that gives the quartz fibre an additional twist by rotating its top, thus making the deflection of the magnetic needle always equal to 90°.

A description of different parts of the instrument is given as well as a theoretical study of its operation with the changes. Experimental data obtained from tests of the modified magnetometer were destroyed in the war and cannot be quoted now, but the functioning of the instrument was essentially improved.—*S. T. V.*

11939. Stenz, Edward. First magnetic determinations in Afghanistan: Geofis. Pura e Appl., vol. 15, fasc. 3–4, pp. 181–185, 1949.

The first determinations of magnetic declination in Kabul, Afghanistan, were made on September 10, 1939, using a Zeiss theodolite, provided with a magnetic compass. As a mean of eight determinations, the value of 2.74° E. was obtained.

Determinations of magnetic declination were repeated in Kabul in 1945–47. The values obtained ranged from 2.10° E. to 2.54° E. The inclination was twice determined and the values of 51°24′ and 51°21′ were found.—*S. T. V.*

11940. Princep Curto, J. M. Un ciclo de bahias en el observatorio del Ebro [A cycle of magnetic bays from the records of the Ebro Observatory]: Rev. Geofis., vol. 8, no. 32, pp. 507–522, 1949.

A statistical study of magnetic bays recorded between 1923–33 at Ebro Observatory, Spain, is presented. Daily, yearly, and secular distributions of geomagnetic bays during this period are shown as histograms. Positive bays appear almost exclusively during the night. The greatest number of bays occur during March and October. The duration of observation was too short to permit determination of a secular periodicity. The importance of studying the variation of the total geomagnetic vector rather than the separate components *H*, *Z*, and *D* is emphasized.—*S. T. V.*

11941. Chen, P. C. A detailed geomagnetic survey of Pehpei district, Szechwan, China: Chinese Geophys. Soc. Jour., vol. 1, no. 2, pp. 177–186, 1949.

A geomagnetic survey of Pehpei [Pei-p'ei Kuan-li-chu] district was made between December 1945 and May 1946, using an Askania theodolite magnetometer, a Schmidt magnetometer for *D* and *H* measurements, and an Askania earth-inductor for *I* measurements. The Institute of Physics of the Academia Sinica was used as base. Fifteen stations were occupied. Values for each were obtained by averaging four observations at different times of the day and reducing these to the common epoch 1946.1. The results of these determinations are presented in a table, indicating for each station its position, observed values of *D*, *I*, and *H*, reductions to the mean of the day, and reductions to the chosen epoch. Isogonic, isoclinic, and isodynamic maps of the district are also included.—*S. T. V.*

SEISMOLOGY

11942. Inglada Ors, Vicente. Resultados de las recientes investigaciones sismologicas [Results of recent seismological studies]: R. acad. cien. Madrid Rev., vol. 42, no. 2, pp. 171–221, 1948.

A review of the causes of earthquakes, and seismological interpretations regarding the internal structure of the earth and depth of focus.—*S. T. V.*

11943. Ramirez, J. E. The new seimic station at Galerazamba, Colombia: Seismol. Soc. America Bull., vol. 40, no. 1, pp. 1–5, 1950.

The location and equipment of the new station are described. *See also* Geophys. Abstract 11707.—*M. C. R.*

11944. **Stoneley, Robert.** The effect of a low-velocity internal stratum on surface elastic waves: Royal Astron. Soc. Monthly Notices, Geophys. Supp., vol. 6, no. 1, pp. 28-35, 1950.

The effect on the surface amplitude of Love waves of a low velocity layer of the type envisaged by Gutenberg and Richter is discussed, and it is shown, so far as it is practicable to make a comparison, that a diminution of about 10 per cent in the velocity of distortional waves in the lower half of a surface layer causes no marked change in the amplitude of Love waves. If there is a high-velocity internal layer, Love waves will not exist for waves longer than a certain critical wave length which depends on the parameters of the system. As a limiting case of the three-media systems considered, it is shown that for sufficiently short wave lengths Love waves can be propagated in a two-layer plate with a velocity greater than the velocity of distortional waves in either layer.—*M. C. R.*

11945. **Altenburg, K.** Dispersion longitudinaler Erdbebenwellen [Dispersion of the longitudinal seismic waves]: Experientia, vol. 5, no. 2, p. 68, 1949.

Absorption of elastic waves propagating through a medium is determined by inner friction, heat conductivity, and intramolecular vibration. Variation of the effect of these factors with frequency causes anomalous dispersion of the waves, so that the waves of shortest period have the greatest velocity of propagation. When the period of the wave approaches the relaxation time, absorption and dispersion reach a maximum, transverse waves cannot be propagated, and the velocity of the longitudinal waves sharply decreases. For seismic waves this is noticeable at a depth of 2,900 km. This value, and therefore the diameter of the earth's core, changes with the period of the wave. These phenomena, predicted by the theory of W. Kuhn and A. Ritmann, are confirmed by the analysis of the seismic waves at epicentral distances up to 8,500 and over 10,000 km. Waves of intermediate epicentral distance evidently reach the observation point by another path.—*S. T. V.*

11946. **Scholte, J. G.** On true and pseudo Rayleigh waves: K. Nederland. Akad. Wetensch. Proc., vol. 52, no. 6, pp. 652–653, 1949.

The change in the form of a plane seismic wave caused by the reflection or refraction at the boundary between two infinitely large media is a function of the angle of incidence. Motion along the boundary surface may be either Stoneley waves or Rayleigh waves. Referring to his study of this problem (*See* Geophys. Abstracts 133, no. 10060) and to a discussion with Prof. Cagniard, the following correction is made as to the kind of seismic waves observed on the surface of the earth: if the density of one medium is very small (atmosphere) a pseudo Rayleigh wave is obtained, almost identical with the theoretical Rayleigh wave. If this medium is ocean water, Stoneley waves are produced.—*S. T. V.*

11947. **Due Rojo, Antonio.** El nuevo sismografo de la estacion sismologica de Cartuja [The new seismograph of the Cartuja seismological station]: Rev. Geofis., vol. 8, no. 32, pp. 470–474, 1949.

A description is given of a new E–W component seismograph which has been in operation at the Cartuja observatory since July 1949, replacing the old Berchman instrument. The new instrument records waves of periods up to 20 seconds. The weight of the pendulum bulb is more than 4½ tons, which necessitates a strong supporting system of steel beams. The natural period of this pendulum can be made as high as 27 seconds. Frictional resistance is very low and contributes to the fidelity of recorded waves.—*S. T. V.*

11948. Ingram, R. E. Note on the magnification curve of a seismograph recording through a galvanometer: Seismol. Soc. America Bull., vol. 40, no. 1, pp. 21–23, 1950.

A general equation is derived linking the constants of the instrument with the earth period. The equation is useful for forming a quick appreciation of the magnification curve and in designing instruments for particular purposes. If T is the period of a seismograph with damping coefficient h, T_1 the period of the galvanometer with damping coefficient h_1, T_E the period of earth movement, and T'_E the period of earth movement for which the magnification is a maximum, then

$$3T'^8_E+4[(2h^2-1)T^2+(2h_1^2-1)T_1^2]T'^6_E+[4(2h^2-1)(2h_1^2-1)T^2T_1^2+T^4+T_1^4]$$

$$T'^4_E-T^4T_1^4=0.$$ —*M. C. R.*

11949. Kisslinger, Carl. Velocity of longitudinal waves in some Paleozoic formations in the vicinity of St. Louis, Missouri: Am. Geophys. Union Trans., vol. 31, no. 2, pt. 1, pp. 169–173, 1950.

Longitudinal wave velocities in five Paleozoic formations which outcrop near St. Louis were determined by a series of short range refraction profiles as follows: St. Peter sandstone, 2.85–2.90 km./sec.; Joachim dolomite, 6.06–6.80 km./sec.; Kimmswick limestone, 1.73–2.06 (?) km./sec.; St. Louis limestone, 3.62–3.86 km./sec.; Cherokee formation, 2.16–2.28 km./sec. in blue shale, 2.9 (?) km./sec. in the Cheltenham fire clay member. $MgCO_3$ content is suggested as a possible dominant factor in controlling the velocity of elastic waves.—*M. C. R.*

11950. Martner, S. T. Observations on seismic waves reflected at the core boundary of the earth: Seismol. Soc. America Bull., vol 40, no. 2, pp. 95–109, 1950.

Ratios of observed ground displacements produced by seismic waves reflected from the earth's core to those produced by direct body waves are definitely larger than expected from currently accepted theory for the $\frac{\text{horizontal displacement}}{\text{period}}$ ratios of $\frac{PcP}{P}$, slightly greater for $\frac{\text{vertical displacement}}{\text{period}}$ ratios of $\frac{PcP}{P}$ and $\frac{\text{horizontal displacement}}{\text{period}}$ ratios of $\frac{PcS}{P}$, and in reasonable agreement for $\frac{\text{horizontal displacement}}{\text{period}}$ ratios of $\frac{ScS}{S}$ and $\frac{\text{vertical displacement}}{\text{period}}$ ratios of $\frac{ScS}{S}$ and $\frac{ScP}{S}$. The discrepancies apparently involve the *PcP* phase and not the *P* phase. Angles of incidence of *PcP* waves at the earth's surface are not in accordance with theoretical values. No single factor of the theoretical formulae for the displacement due to a seismic wave can be changed sufficiently to account for the observed $\frac{\text{horizontal displacement}}{\text{period}}$ ratios of $\frac{PcP}{P}$.—*M. C. R.*

11951. Tolstoy, Ivan and Ewing, Maurice. The *T* phase of shallow-focus earthquakes: Seismol. Soc. America Bull., vol. 40, no. 1, pp. 25–51, 1950.

A short-period phase, 0.5 sec. period or less, traveling through the ocean with the velocity of sound in water has been identified on a large number of seismograms of earthquakes occurring at sea. This arrival was identified on the Benioff short-period seismograms of the Weston, Fordham, and Ottawa stations for a series of Dominican Republic shocks, and on the Benioff short-period seismograms of the Pasadena network of stations and the Mount Hamilton and Mineral stations for a series of major Japanese and Aleutian shocks.

The existence of this phase had been noted previously by Linehan, who was at a loss to provide an explanation for them. The mechanism of propagation of the *T* phase is discussed and several practical applications are described.—*Author's abstract.*

11952. Ewing, Maurice, Tolstoy, Ivan, and Press, Frank. Proposed use of the *T* phase in tsunami warning systems: Seismol. Soc. America Bull., vol. 40, no. 1, pp. 53–58, 1950.

A striking correlation between the occurrence of a short-period earthquake phase (*T* phase) traveling through the ocean with the speed of sound in sea water and the occurrence of tsunamis has been observed. The characteristics of the *T* phase are described and the data upon which the correlation is based are presented. Although further study is needed, the evidence at hand warrants the inclusion of instruments suitable for recording the *T* phase in tsunami warning systems. It is quite possible that sofar listening stations would be valuable adjuncts in the detection of tsunami-producing earthquakes since they offer the best means of recording the *T* phase.—*Author's abstract.*

11953. Press, Frank, Ewing, Maurice, and Tolstoy, Ivan. The Airy phase of of shallow-focus submarine earthquakes: Seismol. Soc. America Bull., vol. 40, no. 2, pp. 111–148, 1950.

An extension of the theoretical work of Lamb and Pekeris shows that a prominent phase (Airy phase) consisting of a group of waves of period 9–11 seconds, traveling across the ocean with a velocity of approximately 0.7 of the speed of sound in water, should be present on the seismograms of shallow-focus submarine earthquakes. This arrival corresponds to normal mode propagation at a stationary value of group velocity through the acoustic system consisting of the ocean and the rigid ocean bottom.

A phase fitting this description has been observed on the Milne-Shaw instruments at Bermuda for a series of Dominican Republic shocks. The Wenner seismographs at Huancayo recorded the Airy phase of a shock southwest of the Galapagos Islands.

The study of the Airy phase of a sufficient number of sea quakes would provide information concerning the nature of the ocean bottom since the latter affects both the periods and velocities of the Airy phase.—*Author's abstract.*

11954. Caloi, Pietro, Marcelli, L., and Pannocchia, G. Sulla velocità di propagazione delle onde superficiali in correspondenza dell' Atlantico [Velocity of the propagation of surface waves under the Atlantic Ocean]: Annali Geofis., vol. 2, no. 3, pp. 347–358, 1949.

The velocities of both Love and Rayleigh waves were determined from the seismograms of about fifty stations for the earthquakes of April 24, 1947 on the mid-Atlantic Ridge. These velocities, both west and east of the Ridge, were very close to those found for the Pacific, casting some doubt on the hypothesis of continental drift.—*S. T. V.*

11955. Di Filippo, Domenico. L'onda "G" di Gutenberg nel terremoto delle Azzorre del 25 novembre 1941 [Gutenberg's *G*-wave in the Azores earthquake of Nov. 25, 1941]: Annali Geofis., vol. 3, no. 1, pp. 39–45, 1950.

The direct *G*-wave and G_2, G_3, G_4, and G_5 were clearly recorded on Rome seismograms of the earthquake near the Azores on Nov. 25, 1941. From records of several European and American stations, the travel time of the direct wave was found to be $t_{sec} = (\Delta°/0.0405 \pm 0.00039) - (0.026 \pm 0.513)$ sec, and the velocity 4.5 km./sec.—*S. T. V.*

11956. Agamennone, Giovanni. Spoglio del materiale del 1947 pervenuto all Ufficio Centrale di meteorologia e geofisica [Data on seismic events during 1947 obtained by the Central Office of Meteorology and Geophysics]: Soc. Sismol. Italiana Boll., vol. 41, no. 1, pp. 30–56, 1948.

This is a summary of data on seismic events received by the Italian Central Office of Meteorology and Geophysics during 1947, collected from both seismological stations all over Italy and private persons. Some 38 earthquakes were noticed during this year, most of them of a very feeble intensity. Only the earthquake of March 11, felt in southern Italy, reached intensity 8. The summary gives the time of the shocks observed in different localities, their duration and a brief characterization. No information on epicenters of the earthquakes is given.—*S. T. V.*

11957. Agamennone, Giovanni. Il terremoto delle Prealpi Carniche del 4 maggio 1934 [The earthquake of May 4, 1934 in the foothills of the Alpi Carniche] Soc. Sismol. Italiana Boll., vol. 41, pp. 1–14, 1948.

The earthquake of May 4, 1934 was outstanding in its intensity (reaching 7 of the Mercalli scale) and area of propagation. It was felt at distances up to 180 km. and was recorded by seismographs at distances up to 1,000 km.

Using Gassmann's formula, the depth of focus was found to be 5–10 km., which is in agreement with data for other earthquakes in this region (except the depth of 14–18 km. for the earthquake of November 18, 1936 found by Caloi). It was impossible to use the data of the Italian seismological observatories on the time of arrival of different phases because of uncertainty of these data, nor could the angle of emergence of seismic waves be utilized because of the very small initial displacements.—*S. T. V.*

11958. Imamura, Akitsune. Land deformations associated with the recent Tōkaidō earthquake: Acad. Japan Proc., vol. 21, no. 3–10, pp. 193–196, 1945 (1947).

Immediately following the destructive earthquake of December 7, 1944 off the coast of Tōkaidō, a resurvey was made of the Mikura-Kakegawa-Omaesaki lines. Precise leveling had been done several times on these lines since 1902 and revised just before the quake. Changes in height of as much as 113 mm. for several points over a horizontal distance of about 20 km. were established. Displacement of the bench marks for previous periods since 1900, indicate that the tilt of the Tertiary block preceding the earthquake was a forerunner of the shock. The data are referred to an arbitrary base and are relative. The precision of the leveling is not indicated.—*S. T. V.*

11959. **Nagata, Takeshi, and Okada, Atsushi.** Land deformation of Muroto Point before and after the Nankaido great earthquake on Dec. 21, 1946: Tokyo Univ. Earthquake Research Inst. Bull. vol. 25, pts. 1–4, pp. 85–89, 1947.

Four precise levelling surveys were made following the earthquake along lines which had been completely or partly surveyed in 1895, 1929, and 1935. It is concluded that the neighborhood of Muroto Point [Muroto-hantō] had been tilting S. 10° E. with nearly constant velocity of 0.0001″ per day until at least 1935 and probably until just before the earthquake. The abrupt tilting motion accompanying the earthquake exceeded 7″. Since the earthquake the area has been rapidly tilting in a S. 10° E. direction with a velocity which is gradually decreasing with time but which is larger than that before the earthquake.—*M. C. R.*

11960. **Pamir, H. N.** Une ligne séismogène en Anatolie septentrionale [A seismotectonic line in northern Anatolia]: Istanbul Üniv. Fen Fakültesi Mecmuasi, ser. A, vol. 9, no. 3, pp. 143–158, 1946.

The origin of violent earthquakes in Anatolia during 1939–45 is discussed. The strongest of these was the first earthquake of December 27–28, 1939 which reached intensity 11 on the Mercalli-Sieberg scale and caused the death of 40,000 persons. Strong aftershocks were felt during January and February 1940, and during 1942–44 numerous earthquakes of intensity 10 occurred in adjoining regions.

The earthquake of December 1939 was caused by a deep tectonic dislocation and produced on the surface a continuous rift 360 km. long, trending northwest from Erzincan through the valleys of Çobanli and Kelkit to the plains of Suşehri. Subsidence on one flank of the rift was in many places as much as one meter; the horizontal opening near Reşadiye was 3.7 meters. The later shocks are attributed to a series of secondary tectonic movements, some of great intensity, but all of the same character as the first.—*S. T. V.*

11961. **Heinrich, R. R.** The Mississippi Valley earthquake of June 30, 1947: Seismol. Soc. America Bull., vol. 40, no. 1, pp. 7–19, 1950.

The epicenter of the earthquake of June 30, 1947 ($04^h23^m53.1^s$ G. c. t.) was located near the confluence of the Meramec and Mississippi Rivers a few miles south of St. Louis, Mo. The earthquake originated in a basement zone of transitional structure between major tectonic elements, and seems to be genetically related to those along the Ste. Genevieve fault, the Duquoin flexure, and the northeastern Ozark flank. The earthquake occurred as the Mississippi River at St. Louis was reaching the crest of one of the largest floods in history, but whether or not the flood triggered the earthquake cannot be determined.—*M. C. R.*

11962. **Ol', A. I.** Microseisms and solar activity [in Russian]: Priroda, no. 2, pp. 3–6, 1950.

Bath's suggested correlation between microseismic activity and the path of the cyclones in the Northern Hemisphere is questioned. From the observations of L. A. Vitels, it is concluded that the curve of the variation of microseisms is identical with that of the intensity of cyclones, but not of their path. This curve is probably related to variation of sun spots. The necessity of further study of the problem is stressed.—*S. T. V.*

11963. Kishinouye, Fuyuhiko, and Ikegami, Ryohei. A study of microseisms after A. W. Lee's method: Tokyo Univ. Earthquake Research Inst. Bull., vol. 25, pts. 1–4, pp. 43–48, 1947.

Studies of microseisms at Tokyo do not confirm results elsewhere that direction of travel can be clearly determined.—*M. C. R.*

11964. Ylinen, J. Mikroseismin ja sään välisestä yhteydestä [Relationship between microseisms and weather] [In Finnish with German abstract]: Terra, vol. 61, no. 1, pp. 52–59, 1949.

The seismograms of the Helsinki Observatory were compared with the meteorological data related to wind conditions on the Atlantic coast of Norway. The entire length of the coast line was divided into six sections, the corresponding velocity of the wind computed from the isobars, and "pressure factors" were assigned to observed wind directions ranging from zero for wind blowing perpendicularly from the coast toward the ocean to four for wind directed toward the continent. Wind velocities were multiplied by the pressure factors, the products added for all six sections, and the result assumed to be representative of surf action. Comparison with the corresponding seismograms showed that in most cases the maximum amplitude of microseismic waves was observed six to twelve hours after the maximum surf, except when the center of the barometric maximum was over the continent. An increase in the period of the microseisms with increasing amplitude was also observed.—*S. T. V.*

ELECTRICITY

11965. Mironov, A. T. Electrodes for electrical measurements in sea water [in Russian]: Akad. Nauk SSSR Doklady, vol. 70, no. 5, pp. 825–827, 1949.

$PbSO_4$ is recommended for electrical measurements in sea water. It has a self-potential of only a few millivolts and this potential difference remains constant. $PbSO_4$ plates from old storage batteries may be used or plates covered with a film of $PbSO_4$ may be prepared from the lead sheaths of cables. By treating the plates in a bath of sea water, it is possible to obtain electrodes showing a constant difference of potential of only a fraction of a millivolt.—*S. T. V.*

RADIOACTIVITY

11966. Festa, C., and Santangelo, M. La radioattività della terra [Radioactivity of the earth]: Annali Geofis., vol. 2, no. 4, pp. 503–517, 1949.

The distribution of radioactive elements in the crust and interior of the earth and its effect in problems of age and internal heat determinations are reviewed.—*S. T. V.*

11967. Slätis, Hilding. Experiments in the possibility of increasing the efficiency of gamma-counters: Rev. Sci. Instruments, vol. 20, no. 5, pp. 353–354, 1949.

Several modifications of the design of Geiger-Müller counters made during experiments in the Nobel Institute for Physics in Stockholm are described. A higher efficiency of the counter was obtained by the introduction into the tube of a system of absorbing solid bodies in the form of concentric rings supported by mica plates. The anode wire was of tungsten and was kept stretched by a spring, and the individual rings were kept at potentials corresponding to their position in an undisturbed electrical field created between the charged wire and the cylinder. Good plateaus and resolving times were thus obtained. The efficiency of the counter having three ring systems with twenty-four rings in each system was two and one-half times that of a conventional counter of the same size. The resolving time of the new counter was found to range from 1 to 6×10^{-4} seconds.—*S. T. V.*

11968. Reynolds, G. T. Liquid scintillation counters: Nucleonics, vol. 6, no. 5, pp. 68–69, 1950.

The scintillation properties of a series of solutions were investigated, among them solutions of dibenzyl in ether, naphthalene in benzene, xylene, and terphenyl in m-xylene, in benzene, in toluene, and in cyclohexane. The terphenyl solutions seem to be the most appropriate for the purpose. Pulse heights equal to those of good stilbene crystals can be obtained from clear solutions of terphenyl. Because large cells of clear solutions are so simply prepared, it will now be possible to replace counters previously requiring very large, fast detectors.

Results of experiments with different solutions are given, and a graph shows the effect of concentration of terphenyl in m-xylene on the functioning of the counter—*S. T. V.*

11969. Ives, R. L. Laboratory power supply for vibrator-type portable Geiger-counters: Econ. Geology, vol. 45, no. 3, pp. 245–248, 1950.

Vibrator-type counters operating from two 3-volt flashlight cells may be powered in the laboratory from a simple inexpensive transformer-rectifier-filter device. The power supply consists of a small step-down transformer which reduces the line voltage to about six volts and isolates the power line from the output. The rectifier is a medium-current bridge-type selenium unit and the filter a 1,000 microfarad dry electrolytic unit, both standard radio parts. A circuit diagram is given.—*M. C. R.*

11970. Ageno, Mario, Chiozzotto, Mario, and Querzoli, Ruggero. Sulla nuova tecnica dei contatori a scintillazione [A new technique in the design of the scintillation counters]: Accad. Naz. Lincei. Cl. sci. fis., mat e nat. Rend., vol. 6, fasc. 4, pp. 453–457; fasc. 5, pp. 626–631, 1949.

The properties of scintillation counters, the influence of surrounding temperature, and the relation between the intensity of irradiation and the intensity of the current generated in the photo-tube are reviewed.

The small dimensions of crystals present limitations to the sensitivity of the counters in cases of weak radioactivity. An attempt was made to replace the solid crystals by solutions of different salts. The intensity of scintillation caused by thorium salt was found to be influenced by the kind of solvent used. The scintillating solution was placed in a flat container in front of the photo-tube and was irradiated by thorium salt; the tube was cooled by solid CO_2. The best results were obtained with the solution of naphthalene in xylol.—*S. T. V.*

11971. Damon, P. E. Radioactivity and mineralization in rhyolite porphyry: Geophysics, vol. 15, no. 1, pp. 94–101, 1950.

Measurements of hard gamma radiation from the pre-Cambrian rhyolite porphyry of the Bourbon, Mo., well core indicate a direct relationship between mineralization and radioactive content, low activities being associated with high mineral density. Mineral density is directly related to iron content and steadily increases with depth. The low radioactivity of mineralized sections may be the result of leaching out of the potassium content.—*M. C. R.*

HEAT

11972. Casertano, Lorenzo. Sul contributo termico derivante dalle disintegrazione radioattive nella terra [The contribution of heat derived from disintegration of radioactive substances in the earth]: Geofis. Pura e Appl., vol. 15, fasc. 1–2, pp. 54–59, 1949.

The amount of heat resulting from radioactive disintegration of potassium is discussed. Urry's formula is found very convenient for the computation of the heat produced, but with certain changes in the value of the numerical constants.

From a critical analysis of some twenty data obtained by different scientists Urry's formula is written as:

$$H=2.1\times10^{-6}N+23.95\times10^{-6}a$$

in which H is the number of calories produced by a gram of K_2O; N is the number of alpha particles emitted, and a is the K_2O content in a gram of the substance under investigation. In the proposed formula the K content of the crust to a depth of 40 km. is assumed as 2.58×10^{-2} gr./gr., and specifically 3.99×10^{-2} for granite; 1.09×10^{-2} for calcareous formations, and 0.27×10^{-2} for arenaceous rocks.—*S. T. V.*

11973. Thomson, J. E. Geology of the main ore zone at Kirkland Lake: Ontario Dept. Mines Rept., vol. 57, no. 5, pp. 55–62, 1950.

As part of the geological study of the main ore zone at Kirkland Lake, Ontario, geothermal measurements were made to depths of 7,200 feet in the Lake Shore and Wright-Hargreaves mines. The accuracy of the temperature measurements is estimated as ±0.1° F. At depths of less than 3,500 feet points of equal temperature do not lie on planes parallel to the surface. Thus, the heat flow is not strictly perpendicular to the surface, and temperature gradients may be quite different at nearby points. Below 3,500 feet reliable temperature gradients may be calculated. The average temperature gradient below 3,500 feet was 1° F. per 140 feet, or 4° C. per 252 feet.—*S. T. V.*

VOLCANOLOGY

11974. Perret, F. A. Volcanological observations, 162 pp., Carnegie Institution of Washington, Pub. 549, 1950.

This is a condensed record of personal observations over a period of some forty years of volcanological studies. It includes descriptions, illustrated by numerous pictures, of volcanic eruptions of widely different types in different parts of the world, which were observed at close range. Among other subjects discussed are: the causes contributing to formation of a volcano; volcanic liquid and gases; electric and atmospheric phenomena observed during an eruption; volcanic ash and its composition; gravitational and volcano-seismic phenomena; prediction of eruptions; and suggestions for observing volcanic eruptions, including instructions for use of photographic equipment, thermometric instruments, apparatus for gas collection, sound recording, and study of lava samples.—*S. T. V.*

11975. Fries, Carl, Jr., and Gutiérrez, Celedonio. Activity of Parícutin volcano from August 1, 1948 to June 30, 1949: Am. Geophys. Union Trans., vol. 31, no. 3, pp. 406–418, 1950.

During the period covered by this report, Parícutin's activity continued on about the same scale as the previous two years. The quantity of ash erupted decreased, but eruption of vapor and bombs continued with roughly the same intensity as the previous year. Changes in the outward form of the cone were slight. Lava continued to issue without interruption from the vent formed at the northeast base of the cone in Feb. 1948, and the vent area at the southwest base of the cone remained inactive. The rate of lava flow between August and January was moderate to great but the volume decreased notably early in February and remained smaller until the end of June.—*M. C. R.*

11976. Pough, F. H. The geologic history of Parícutin: New York Acad. Sci. Trans., ser. 2, vol. 11, no. 2, pp. 28–33, 1948.

An account is given of the formation and early activity of the volcano Parícutin on the basis of photographic records assembled into a film.—*V. S.*

11977. Vlodavets, V. I. The volcanoes of the Soviet Union [in Russian]: 162 pp., Moscow, Geografizdat, 1949. Reviewed in Vses. Geogr. Obsch. Izv., vol. 82, no. 1, 1950.

General questions of volcanism, properties of magma, genesis of geysers and hot springs are briefly discussed. The book is chiefly devoted to a description of the present and past volcanic activity in the U. S. S. R. Detailed descriptions are given of activity in Kamchatka Peninsula, the Kuril Islands, the Caucasus, Lake Baikal region, Central Asia and northeastern Siberia. An extensive bibliography is included.—*S. T. V.*

11978. Goguel, Jean. Introduction à l'étude mécanique des deformations de l'écorce terrestre [Introduction to the study of mechanics of the deformations of the crust of the earth]: Memoires pour servir à l'explication de la carte géologique détaillée de la France, 523 pp., 1948.

The second edition of this work takes into account the most recent studies on the subject and the investigations of the American scientists, which were unavailable in France during the publication of the first edition.

The book is divided into five parts. The first part deals with the mechanics of the earth, including astronomical and geodetic data on its dimensions and shape, distribution of mass in its interior, isostatic compensation and its geological significance, earth tides, pressure and temperature distribution, sources of heat development, and propagation of seismic waves. The second part is devoted to the theory of elasticity and a discussion of experimental studies on the plastic behavior of the earth's mass. The third part is a mathematical study of elastic, plastic, and viscous deformations. Simple geological deformations such as that of a stratified formation, warping of a thick bed, or genesis of faults and geological deformations of greater extent are analyzed, in parts four and five.—*S. T. V.*

TECTONOPHYSICS

11979. Glaessner, M. F. Geotectonic position of New Guinea: Amer. Assoc. Petroleum Geologists Bull., vol. 34, no. 5, pp. 856–881, 1950.

Available data on geotectonic relations in the New Guinea area are reviewed to provide a basis for discussion of the fundamental structural features and dynamics of that part of the Pacific margin. The island is tentatively divided into twelve structural zones. Its present geographical unity has been superimposed on a heterogeneous foundation mainly by very young upwarping and downwarping in a direction parallel to the Pacific border. Southern and central New Guinea are essentially Australian, and represent parts of marginal areas which are elsewhere submerged as parts of the continental shelf. Western New Guinea is strongly influenced by the structural trends of the East Indies. The area between Australia proper and the Pacific border is a major geosynclinal belt. Northern and eastern New Guinea forms part of the Melanesian structural belt. Geologic and gravimetric studies in New Guinea and New Zealand may make it possible to test theories which have directly or indirectly made assumptions on the nature and age of structural elements in this area.—*M. C. R.*

11980. Hess, H. H. and Buell, M. W., Jr. The greatest depth in the oceans: Am. Geophys. Union Trans., vol. 31, no. 3, pp. 401–405, 1950.

Review of information concerning the deepest soundings in the oceans suggests that previously accepted values for the Emden and Ramapo deeps are somewhat in error and that the Cape Johnson deep in the Mindanao trench is probably the deepest valid sounding thus far obtained. The Cape Johnson soundings, some 45 miles north of the Emden deep, indicate a depth of 5,740 fathoms.—*M. C. R.*

INTERNAL CONSTITUTION

11981. Bullen, K. E. Compressibility-pressure hypothesis and the earth's interior: Royal Astron. Soc. Monthly Notices, Geophys. Supp., vol. 5, no. 9, pp. 355–368, 1949.

The hypothesis has been set down that at pressures ranging from 0.4×10^{12} to at least 3.6×10^{12} dynes/cm.^{2} (the latter being the pressure at the earth's center) the compressibility k^{-1} of a substance at temperatures of the order of those in the earth's deep interior is essentially independent of its chemical composition. A simple form of the hypothesis to the effect that k and dk/dp (where p denotes pressure) change continuously and smoothly throughout the earth below a depth of 1,000 km. has been discussed in relation to seismic data. The hypothesis entails an abnormally large density gradient in the lowest 200 km. of the earth's mantle, and in the earth's inner core, and that these two regions are not chemically homogeneous. It entails that the density near the earth's center lies between about 16 g./cm.^{3} and 20 g./cm.^{3} (apart from a possible accumulation of even denser material very close to the center). The hypothesis in its simplest form would require the earth's density to be a little higher in the region above the 1,000-km. level than the figures given in a previous model. The hypothesis would entail that the inner core is solid, capable of transmitting S waves at a speed not less than about 4.9 km./sec. and probably less than 6.0 km./sec.—*Author's abstract.*

11982. Bullen, K. E. An earth model based on a compressibility-pressure hypothesis: Royal Astron. Soc. Monthly Notices, Geophys. Supp., vol. 6, no. 1, pp. 50–59, 1950.

In an earth model based on the compressibility-pressure hypothesis, there is a sharp increase of density from 3.36 to 3.57 g./cm.^{3} at a depth of 80 km. and thereafter a fairly steady density gradient to a depth of 2,700 km. The gradient increases sharply between 2,700 and 2,900 km., being 5.57 g./cm.^{3} at the base of the mantle. Density within the central core ranges from 9.74 to 12.00 g./cm.^{3} at a depth of 4,980 km. and then increases sharply to between 17 and 18 g./cm.^{3} at the center. *S* waves would be transmitted through the inner core at speeds of about 5 km./sec.—*M. C. R.*

11983. Bullen, K. E. On the constitution of Mars: Royal Astron. Soc., Monthly Notices, vol. 109, no. 6, pp. 688–692, 1949.

An earth model based on a compressibility-pressure hypothesis fits theories that the density change at the boundary of the earth's central core is purely a pressure phenomenon and that the earth and Mars are of the same primitive composition. The best fit is found if Mars is assumed to have an inner core in the same proportion by mass as in the earth and if the material in the inner core of the earth is chemically distinct from the material below the crust. The moment of inertia and ellipticity of Mars lend some support to these suggestions. —*M. C. R.*

11984. Ramsey, W. H. On the compressibility of the earth: Royal Astron. Soc. Monthly Notices, Geophys. Supp., vol. 6, no. 1, pp. 42–49, 1950.

An attempt is made to show how the compressibilities found by seismological means can be understood on the basis of the atomic theory of solids, with the investigation confined to those aspects of the problem which do not require a detailed knowledge of the interaction between ions and which are comparatively insensitive to chemical composition. The constant α in the relation $k=k^0-\alpha p$ expressing the bulk modulus as a linear function of pressure is found to lie between 3 and 4. This constant decreases at every transition to a metallic phase but the decrease is very small. Values of α in the core and mantle are approximately equal. The sudden increase in velocity of longitudinal waves at the inner core must then be ascribed to an increase in rigidity, leading to the conclusion that the core is solid.—*M. C. R.*

11985. Ramsey, W. H. On the nature of the earth's core: Royal Astron. Soc. Monthly Notices, Geophys. Supp., vol. 5, no. 9, pp. 409–425, 1949.

In a previous paper the author has suggested that the density jump at the boundary of the earth's core is due to a phase transition under pressure, and not to the appearance of a new material such as iron. A metallic type of structure was proposed for the material in the core. In the present paper the transition to the metallic phase is explained in greater detail. Seismological data are used to prove that the core cannot be composed of either iron or an alloy of iron and nickel. It is shown how the theory removes certain difficulties arising from the hypothesis of an iron core, and how it can account for features not hitherto explained.—*Author's abstract.*

11986. Bullard, E. C. The transfer of heat from the core of the earth: Royal Astron. Soc. Monthly Notices, Geophys. Supp., vol. 6, no. 1, pp. 36–41, 1950.

The dynamo theory of the origin of the earth's magnetic field requires a motion of the material of the core which may possibly be the result of thermal convection. As neither the temperature, rate of heat generation, nor conductivity of the core is known, any discussion must be inconclusive. It is possible to choose a set of constants which would not cause convection and which could not be shown to be inadmissible, but there is no difficulty in choosing admissible constants which will give convection. These conditions are more easily satisfied if the heat is removed from the core by convection in the mantle than if it is transported by conduction because the temperature of the core is then lower and there is a greater range between the heat flow necessary to maintain the adiabatic gradient and the maximum amount that can plausibly be supposed to arrive at the surface of the earth.—*M. C. R.*

11987. Elsasser, W. M. Causes of motions in the earth's core: Am. Geophys. Union Trans., vol. 31, no. 3, pp. 454–462, 1950.

Secular variation of the earth's field may be attributed to motions in the fluid, electrically conducting core. Fluid motions on the earth are of two general types, being either of thermal or of gravitational origin, but thermal convection seems to be the only satisfactory mechanism for motion in the core. If 5 to 10 percent as much radioactivity as is found in the crust were concentrated in the inner core, convection would take place. Three models of a convective core are suggested: one in which the heat supplied to the lower boundary of the liquid layer exceeds the amount that can be carried away by conduction alone; another in which the heat flow in the mantle adjacent to the core is in excess of purely conductive heat transport in the core itself; and a third in which the heat supplied at the lower boundary is carried to the upper boundary by convection and then carried away by the mantle. No choice among them can be made. The effects of gravitational perturbations by the moon and sun, such as tides in the core, effects of the equinoctial precession, and slowing down of the earth's rotation by tidal friction, are not sufficient to explain motions of the magnitude observed in secular variation.—*M. C. R.*

11988. Elsasser, W. M. The earth's interior and geomagnetism: Rev. Modern Physics, vol. 22, no. 1, pp. 1–35, 1950.

This review summarizes the state of knowledge of the earth's fair interior, omitting the information that pertains to the crust proper. Seismic and geochemical data and the mechanical and thermal properties of the interior are reviewed. The last section is devoted to an exposition of the mechanics of terrestrial magnetism as developed by Bullard and Elsasser. *See* also Geophys. Abstracts 11476 and 11987—*M. C. R.*

11989. Jeffreys, Harold. Dynamic effects of a liquid core: Royal Astron. Soc., Monthly Notices, vol. 109, no. 6, pp. 670–687, 1949.

The effect of the inertia of the earth's core may be neglected in discussions of the semidiurnal, fortnightly, and semiannual tides, but must be considered for those depending on terms of the forms zx, zy in the gravitational potential. A theory of these is developed for an earth model of the Wiechert type, with a fluid core, and applied to the free variation of latitude and the lunar nutation. With a rigid shell, a fluid core would produce a shortening of the free period, contrary to observation; but with a shell of rigidity of 1.9×10^{12} dynes/cm^2, the motion induced in the core is much less than with a perfectly rigid shell, and agreement between theory and observation can be obtained with a rigidity differing little from what was found satisfactory when the inertia of the core was neglected.

Fluidity of the core has been seen to be capable of reducing the amplitude of the lunar nutation by about three times as much as the present discrepancy between theory and observation. Allowance for elasticity of the shell reduces this; allowance for the obliquity of the ecliptic further reduces the correction for the nutation in latitude, but increases that for the nutation in longitude. Even for the nutation in latitude the correction remains too large, but possibly not too large for the excess to be due to inaccuracies of the Wiechert model.—*M. C. R.*

11990. Lozano Calvo, Luis. Sobre la densidad y presiones en lo interior de la Tierra [Density and pressure in the interior of the earth]: Rev. Geofís., vol. 8, no. 32, pp. 431–448, 1949.

A critical analysis is made of different equations for determining density as a function of depth, as derived from discontinuities in the structure of the crust revealed by seismological observations. Among those considered are the Wiechert, Marsh, Boaga, Stieltges, Azcona y Masia, Haalck, Bullen equations. Two equations are proposed, one for the crust, another for the core.—*S. T. V.*

EXPLORATION GEOPHYSICS

GENERAL

11991. Archie, G. E. Introduction to petrophysics of reservoir rocks: Am. Assoc. Petroleum Geologists Bull., vol. 34, no. 5, pp. 943–961, 1950.

The term petrophysics is suggested for the physics of particular rock types in comparison to geophysics which pertains to the physics of larger rock systems. The petrophysics of reservoir rocks here discussed include those physical properties which are related to pore and fluid distribution. Porosity, permeability, capillary pressure, hydrocarbon saturation, fluid properties, electrical resistivity, self-potential, and radioactivity of different types of rocks are investigated separately and in relation to each other as they pertain to the detection and evaluation of hydrocarbon-bearing layers. A tentative petrophysical system is presented, revolving mainly around pore-size distribution which defines the capillary-pressure curve, porosity, and permeability.—*M. C. R.*

11992. Kunz, Bruno. Der Gradient in der Geophysik [The gradient in geophysics]: B. B. Z. [Bergbau-Bohrtechniker-und Erdöl-Zeitung], Jahrg. 65, Heft 10, pp. 4–5, Heft 11, pp. 6–7, 1949.

The gradient, as used in geodesy and geophysics, is defined and illustrated using mesaurements of temperature, gravity and other physical properties. The relation between the gradient and the numerical value and direction of a physical quantity itself is discussed.—*S. T. V.*

11993. Hysom, R. L. The search for oil: The Colorado Engineer, vol. 46, no. 4, pp. 9–11 and 38, 1950.

The North American gravity meter is described and the use of a helicopter in gravitational surveys is outlined.—*S. T. V.*

11994. Geoffroy, P. R. and Koulomzine, T. Need for new policies and new tools in mining geophysics: Canadian Min. Met. Bull., vol. 43, no. 458, pp. 313-315, 1950.

There is an immediate need to develop new tools and methods in mining geophysics, comparable to the progress in petroleum exploration. Measurement of physical properties in diamond-drill holes is suggested. Induced potential and spontaneous polarization have already yielded positive results, and magnetic and gravimetric measurements are also feasible. Radioactive methods are another possible development.—*M. C. R.*

11995. Kelly, S. F. Geophysical and geological approach to mining problems: Mining World, vol. 11, no. 11, pp. 37, 38, 40, and no. 12, pp. 40, 44, 46, 1949.

The fundamentals of the gravimetric, magnetic, seismic, and electric methods of exploration are briefly outlined. The types of problems to which each is applicable, and the geological circumstances which must be considered in deciding what techniques should be applied to derive the maximum geological information are described.—*M. C. R.*

11996. Lundberg, Hans. Current trends and progress in mining geophysics: Colorado School of Mines Quart., vol. 45, no. 4A, pp. 41–47, 1950.

Since World War II developments in geophysical exploration have been completely revolutionized. Developments in aviation and electronics have made possible magnetic surveys from the air and soon gravity surveys will also be made in this way, requiring only 1/50 to 1/150 of the time necessary to do the same work on the ground. The cost of an airborne survey is as low as 1/100 of the cost of similar survey on the ground. The possibility of flying at different heights permits a three dimensional geophysical picture of the region, important in determining the depth of disturbing bodies. Airborne methods lend themselves best to regional surveys, although detailed studies of small areas are also quite easily accomplished.—*S. T. V.*

11997. Raggatt, H. G. Depletion of mineral resources—A challenge to geology and geophysics: Australian and New Zealand Assoc. Adv. Sci. Rept., 26th meeting, pp. 109–133, 1948.

Large quantities of minerals consumed during the Second World War accelerated depletion of resources to such an extent that the known deposits of many minerals will be exhausted in the foreseeable future. New, more effective methods of exploration for minerals must be discovered and used.—*S. T. V.*

11998. Kelly, S. F. Geophysics in the exploration, exploitation, and conservation of water; Mines Mag., vol. 39, no. 11, pp. 13–21, 1949. (Presented at the First Pan-American Engineering Congress, Rio de Janeiro July 1949, and accepted for publication in full in the Annals of the Congress.)

Geophysical exploration for water may be either indirect by mapping structural features affecting a known or presumed aquifer or direct, by detecting water itself, usually as a water-table in alluvium, gravels, and glacial till because of the better electrical conductivity of water-soaked formations and increased velocity with which they transmit seismic waves. In the exploitation of water resources, observations of electrical resistivity, natural formation potentials, radioactivity, thermal gradient, hole diameter, and fluid flow when integrated with geologic data may furnish information regarding positions of cement casings, and liners, and porosities of formations, inflow of saline water, loss of water through creviced formations, sources of contamination, depth to and thickness of water-producing horizons, and possibility of increasing yields by deepening wells. Electrical and seismic methods are used also for determining depth to and characteristics of bedrock. This information may be used in guiding locations of proposed water tunnels, and facilitating choice of dam sites. Typical electrical resistivity surveys for water in Palestine, Spain, Uganda, and Peru are described, as well as surveys for dam and bridge sites and activities of geophysical units of the Geological Section of the South African Engineering Corps.—*M. C. R.*

11999. Beck, A. F. Western Canadian plains—A new challenge to geophysics: Canadian Min. Met. Bull., vol. 43, no. 455, pp. 132–134, 1950.

A review of the electric, magnetic, gravity, and seismic methods and the problems of operation in the western Canadian area.—*M. C. R.*

12000. Evans, P., and Coates, J. Geophysical prospecting for oil in India: Indian Minerals, vol. 2, no. 4, pp. 219–225, 1948.

This is a continuation of a previous article by the same authors, (*See* Geophys. Abstract 11443), describing the work of government and private organizations in search for oil in India. In the extensive geophysical surveys of the vast alluvial areas of India, a preliminary gravity survey is usually made and areas are then selected for more detailed investigation by seismic methods. Seismic investigations of this type were conducted in 1931 in the Punjab and in 1938 in the Assam areas without obtaining the desired structural information. With shallow structures, as near Dignoi in Assam, successful electrical surveys have been made.

Magnetic methods are not used in prospecting for oil because the sedimentary rocks with which oil is usually associated contain only a small proportion of magnetic minerals.—*S. T. V.*

12001. McGee, D. A., Seale, Tom, Finley, J. C. Oil in the Gulf of Mexico: Oklahoma Acad. Sci. Proc., vol. 29, pp. 60–61, 1950.

Oil along the Texas and Louisiana coasts is produced almost exclusively from salt dome structures, varying in character from very shallow, piercement type domes to large, deep-seated salt masses. Seismic work off the Louisiana coast has demonstrated that salt domes of the same general type and character as those found on land extend out to a distance of at least thirty miles from the shore. Exploration work is now being carried on at distances greater than this. Gravimetric data indicate the presence of salt domes out to and possibly seventy-five miles beyond the shore. It seems logical to assume that the total oil reserve in this area will exceed that of the coastal land area.—*S. T. V.*

12002. Macelwane, J. B. Survey of geophysical education in the United States and Canada in 1948: Geophysics, vol. 15, no. 2, pp. 257–263, 1950.

A total of 150 universities and colleges teach at least one course in geophysics, according to replies to a questionnaire sent to 426 institutions. The types of geophysics courses offered at each institution are tabulated.—*H. R. J.*

12003. Monges Lopez, Ricardo. El Instituto de geofísica de México [Geophysical Institute of Mexico]: Ciencia, vol. 9, no. 11–12, pp. 321–322, 1949.

A National Institute of Geophysics has recently been established as a separate scientific organization associated with the University of Mexico. The Institute will have six sections: Seismology, Geomagnetism, Geodesy, Geomechanics, Volcanology, and Applied Geophysics. The last section will prospect for underground water and oil in cooperation with Petroleos Mexicanos. The Section of Geomechanics will be the center of studies concerning soil mechanics and its applications in civil engineering. Sections of Oceanography and Meteorology are planned for the future.—*S. T. V.*

12004. Informaciones y Memorias de las Sociedad de Ingenieros del Peru. El Observatorio Geo-fisico de Huancayo [The geophysical observatory of Huancayo]: Vol. 5, no. 8, p. 348, 1949.

The Huancayo Observatory and its equipment are briefly described. Magnetic, meteorological, seismological and ionospheric investigations are carried on.—*S T. V.*

12005. Jaroszewicz-Halicka, Antonina. Prace nad organizacją w Warszawie Międzyuczdnego Institutu Geofizyki [Organization of the Interdepartment Geophysical Institute of Warsaw]: Wiadomości museum ziemi, vol. 4, pp. 273–274, 1949.

The Geophysical Institute of Poland, now being reorganized, will have two research centers—one devoted to applied geophysics at Kraków, associated with the local school of mines, the other at Warsaw. The latter will have three sections for studies of the crust of the earth, the atmosphere, and the hydrosphere, and will operate the meteorological observatory at Swirdze and the seismological observatory.—*S. T. V.*

GRAVIMETRIC METHODS

12006. Garcia Rojas, Antonio. Exploración Gravimetrica [Gravimetric exploration]: Petroleos Mexicanos, no. 78, pp. 13–38, 1950.

The basic principles of geophysical exploration by gravimetric methods are discussed. A brief description of the Mott-Smith gravimeter is given and the corrections to be applied to its readings are defined. Reductions leading to the determination of the gravitational anomalies of a surveyed region are also discussed. The interpretation of a gravimetric survey is explained by several examples from Mexican practice.—*S. T. V.*

12007. Kato, Motohiko. On the first and the second differential coefficients of potentials of the arbitrary distributed masses [in Japanese]: Geophys. Exploration, vol. 2, no. 3, pp. 6–10, 1949.

In gravitational or magnetic prospecting, the first and the second differential coefficients of potentials of arbitrarily distributed masses must often be calculated. This calculation is ordinarily complicated, but is can be done simply and with sufficient accuracy by assuming a sphere. Errors when a sphere is assumed are the same in two dimensions.—*M. C. R.*

12008. Cantos Figuerola, José. Investigación hidrologica en Ciudad Real [Hydrological investigation around Ciudad Real]: Rev. Geofis., vol. 8, no. 32, pp. 449–459, 1949.

Gravimetric and electrical-resistivity surveys were made near Ciudad Real, Spain, in search for water. The region surveyed is an area of about 225 sq. km. situated south and west of the Río Guadiana at altitudes of 600 to 715 meters above sea level. Two Nørgaard gravimeters were used in gravitational survey, and 124 stations were occupied, about half of them several times. An arbitrary point on the Madrid-Toledo railroad, where *g* was determined as 978.756 gals, was selected as a base. Bouguer reductions were computed with the density of the ground assumed as 2.0. Anomalies range from 0 to 12 mgal.

Because the ancient impermeable formations covered by Tertiary strata have greater density, it was believed that gravity minima indicate a deepening of the subterranean basins and thus a greater probability of water reservoirs.

The results of the gravitational survey were checked by the electrical method with two profiles: one, 16 km. long with 49 points of measurements, the second, 13 km. long with 24 points. Electrical sounding revealed an impermeable layer at depths of 110 to 150 m. The greatest depth was found at the station having the minimum value of gravity, in good agreement with the gravitational measurements. The article contains graphic and geological maps of the region, two cross sections through geological formations, and graphs presenting the results of electrical measurements over two profiles.—*S. T. V.*

12009. Innes, M. J. S. An investigation of the applicability of gravimetric and magnetometric methods of geophysical prospecting: Canadian Min. Met. Bull., vol. 42, no. 448, pp. 378–384, 1949.

Test surveys were made with both gravity meter and magnetometer over known sulfide concentrations at East Sullivan, Val d'Or, Quebec where the topographic relief is less than 50 ft., the depth of the overburden varies between 0–50 feet, and the average contrast between sulfide body and the surrounding rocks is 0.5. Observations were made at 260 gravity and 190 magnetic stations along north-south grid lines. Stations were 50 feet apart near the ore body, and 100 feet elsewhere. The gravity pattern shows three highs, two over known ore bodies, and a low over the syenite bounding the area. Magnetic highs were associated with mineralized zones. The survey showed that both methods are useful in delineating sulfide deposits under conditions such as those at East Sullivan.—*M. C. R.*

MAGNETIC METHODS

12010. Branham, C. A. A brief commentary on magnetic surveying in the Appalachian area: Appalachian Geol. Soc. Bull., vol. 1, pp. 275–276, 1949.

Magnetic surveying as a method of reconnaissance in studies of structural geology of a region is suggested and described.—*S. T. V.*

12011. Ballarin, S. Isoanomale magnetiche relative ad una massa omogenea di forma parallelepipeda magnetizzata uniformemente dal campo magnetico terrestre [Magnetic isoanomalies caused by a homogeneous parallelepiped uniformly magnetized in the geomagnetic field]: Riv. Geomin., vol. 9, no. 1, pp. 3–31, 1948.

Interpretation of a magnetic survey can be made more easily by a comparison of the isoanomalies obtained with those generated by simple geometric bodies placed in different positions underground.

The computations of isoanomalies are given for parallelepipeds of various dimensions, uniformly magnetized and variously placed with respect to the magnetic field of the earth. The magnetic potential at a point in space by an elemental strip is determined and the disturbing potential produced in this point is found by integrating over the volume of the parallelepiped. This makes possible the finding of the anomalies of the horizontal and vertical components of the geomagnetic vector, as well as anomaly of the declination. Several tables containing the necessary numerical values for calculations are given to facilitate the solution of special problems.—*S. T. V.*

12012. Cassinis, R. I magnetometri a induzione [Induction magnetometers]: Riv. Geomin., vol. 10, no. 2, pp. 59–72, 1949.

Several saturation magnetometers developed in the United States and used in airborne surveying are described. Special attention is given to Gulf magnetometer as described by R. D. Wyckoff (*See* Geophys. Abstracts 8501, 8508, 8670, and 10021).—*S. T. V.*

12013. Bemrose, John, Heggblom, J. C., Holt, T. C., Richards, T. C., and Watson, R. J. Bahamas airborne magnetometer survey: Geophysics, vol. 15, no. 1, pp. 102–109, 1950.

An airborne-magnetometer survey of an area of about 85,000 sq. mi., sponsored jointly by five companies, was flown between May and November 1947. The organization of the survey and some of the technical phases of the operation are described briefly in this paper. (For abstract published in advance of full text, *see* Geophys. Abstract 10769.)—*M. C. R.*

12014. Wier, K. L. Comparisons of some aeromagnetic profiles with ground-magnetic profiles: Am. Geophys. Union Trans., vol. 31, no. 2, pt. 1, pp. 191–195, 1950.

Typical aeromagnetic total-intensity profiles are compared with ground-magnetic vertical-intensity profiles over the same geologic structures in the Iron River district in the northern peninsula of Michigan. Aeromagnetic profiles are strikingly smoother than the ground-magnetic profiles, chiefly because of the merging of adjacent anomalies and a decrease in intensity at greater altitudes. Depth rules applied to aeromagnetic data usually give estimates that are too great because of the complex character of most aeroanomalies.—*M. C. R.*

12015. Cook, K. L. Magnetic surveys in the Iron Springs district, Iron County, Utah: U. S. Bureau of Mines Rept. of Inv. 4586, 77 pp., 1950.

During 1944 and 1945 the Bureau of Mines made magnetometer surveys of some of the principal iron ore deposits of the Iron Springs district, Iron County, Utah, in a belt 23 miles by 3 miles. Most of the large ore bodies are pods of replacement ore in a limestone bed at the margins of three igneous intrusions. The magnetic surveys were confined to these marginal zones. The ore is a mixture of hematite and from 14 to 58 percent magnetite.

About 62,000 magnetometer stations were occupied along a total of 300 traverse miles, and anomalies of over 1,250 gammas were usually found over near-surface ore bodies. Outcropping ore bodies were surveyed to determine their attitude and size, other geologically favorable areas were explored for new ore bodies, and 36 holes in 10 different ore bodies were drilled to correlate the geology and geophysics and check estimates of size and depth of ore.

Forty-five magnetic anomalies were found, 13 caused by outcropping commercial ore bodies and 5 by concealed ore bodies discovered largely by the magnetic survey. The rest are in untested areas of little or no exposed ore, 6 probably, and another 9 possibly over large replacement ore bodies, and 6 are probably caused by unexposed magnetite veins of possible commercial importance.

Strikes of all the ore bodies were indicated by trend and dips estimated from the shape of anomalies, although less reliably for concealed ore bodies. Lengths and apexes of ore bodies near the surface were predicted accurately. Depth and thickness of steeply dipping ore bodies near the surface sometimes could be predicted. Depths of undrilled probable ore bodies could be predicted qualitatively, but if the downdip extent was found by one drill hole, accurate predictions for the rest of the ore body were possible.—*H. R. J.*

12016. Melchiori, G. Erdmagnetische Untersuchungen Sedimentarer Eisenerzvorkommen von Nurra, Sardinien [Geomagnetic investigations of sedimentary iron ore deposits at La Nurra, Sardinia]: Beitr. angew. Geophysik, Band 10, Heft 3–4, pp. 312–331, 1943.

Magnetic prospecting for iron ore in La Nurra, Sardinia, was carried out in great detail with 7,931 stations occupied in an area covering some 3,000 sq. km. A Schmidt magnetic field balance was used. In the surveyed area lenticular ore bodies of siderite and leptochlorite with accessory magnetite of relatively weak magnetic susceptibility are found. The presence of a sufficient amount of magnetite, however, made it possible to obtain a satisfactory magnetic picture with pronounced contrasts. Iron ores of not less than 1,700,000 tons were discovered. The presence of ore bodies was fully confirmed by subsequent drilling. Details of the magnetic measurements, profiles, and results of the exploration in the form of geological maps of the region are included.—*S. T. V.*

12017. Ermert, E. A. Magnetometrische Untersuchung eines Syenitganges am westlichen Witwatersrand [Magnetic exploration of a syenite reef at western Witwatersrand]: Beitr. angew. Geophysik, Band 11, Heft 2, pp. 121–134, 1944.

Several dikes with sufficient magnetite to be traced by a field balance were discovered by a magnetic survey of the western Witwatersrand. These dikes, when the surrounding rock is dolomite, act as underground dams, forming underground reservoirs of water which must be avoided in mining operations. The magnetic polarity of the dikes is commonly opposite to that of the shales and the earth's field.—*S. T. V.*

SEISMIC METHODS

12018. Heroy, W. R., and Arnett, R. A. Seismic surveying: Appalachian Geol. Soc. Bull., vol. 1, pp. 265–274, 1949.

The basic principles of seismic methods of exploration are presented. The necessary equipment, including special trucks, drilling rigs, and so on, is described and information on the organization of an exploration party is given.—*S. T. V.*

12019. Green, C. H. The relationship of research and field operations in seismic explorations: Colorado School of Mines Quart., vol. 45, no. 4A, pp. 1–9, 1950.

An historical outline of changes in methods and techniques of exploration geophysics, especially seismic exploration, is presented. The necessity of continuous integration of various methods of exploration is now generally agreed upon, as well as the coordination of geology with geophysics. The necessity of scientific research for future progress in geophysical exploration is emphasized. This research must be of two kinds: short-range, in the form of improvements in equipment design and field instrumentation; and fundamental investigations, in the fields of geology, physics, and seismology. These should be carried on apart from production operations and without restrictions.—*S. T. V.*

12020. Anderson, H. H. A hazard in oil exploration: Explosives Engineer, vol. 27, no. 6, pp. 179–183, 1949.

One of the dangers in seismic exploration is the hazard of induced electrical energy in the firing line of the blaster. Such extraneous electricity may originate from current induced from the boat's radio and transmitting antennae in the absence of any physical connection, from static electricity in the ground and in the equipment, or from electrical charges in the atmosphere. Detonation of the blasting cap may be also produced if lightning strikes nearby.

Hazards from stray currents can be greatly decreased by adoption of a few preventive practices, such as keeping the blasting line in serviceable condition, leaving shunts on all caps in place until final connections are ready and short-circuiting the firing line itself.—*S. T. V.*

12021. Schoff, S. L. Seismograph shooting and water wells: Oklahoma Acad. Sci. Proc., vol. 29, p. 44, 1948.

Occasional reports indicate that seismic shooting by oil surveying parties adversely affects some water wells, the usual report being that the yield of water is reduced or that the water has become muddy. Most of the reports of well failure as a result of seismic shooting cannot be confirmed because little information is available on the relation of water well and the shot hole. It seems improbable that failure can occur where there is a substantial distance between the shot hole and water well. It is likely that only in wells fed through open cracks could an adverse effect be observed as a result of the closing of joints.

It is also known that some water wells are "shot" to improve their yield so that seismic shooting may sometimes improve rather than harm water wells.—*S. T. V.*

12022. Tartakovskii, B. D. On the theory of propagation of plane waves through homogeneous strata [in Russian]: Akad. Nauk SSSR Doklady, vol. 71, no. 3, pp. 465–468, 1950.

When plane waves are propagated through n homogeneous plane strata the coefficients of reflection and refraction taking place on each stratum can be determined from a system of $2(n+1)$ equations containing the potentials of the direct and returning waves at each of the separating planes. Solution of this system of linear equations can be substantially simplified because all but three members in each line of the determinant are equal to zero, and certain recurrent relations between the coefficients of adjoining equations can be established, which make possible the evaluation of the determinant.

General formulas, giving the values of the reflection and refraction coefficients, entering into consecutive equations, are derived. The correctness of these expressions is checked in some special cases, such as perpendicular arrival of the incoming wave.—*S. T. V.*

12023. Trappe, F., and Zettel, W. Ein neuartiger elektrischer Feldseismograph [A new type electrical seismograph for field use]: Beit. angew. Geophysik., Band 10, Heft 3–4, pp. 259–264, 1943.

A new seismograph for use in seismic exploration is described. Because of transportation difficulties, the mass of the pendulum is very small, and the magnification is electrodynamic. The weight of the instrument is only 6 kg., including a watertight housing. The principal element of the seismograph is a coil oscillating in the annular slot of an iron-clad magnet with an adjustable core. Displacement of the coil generates an electromotive force which is measured by an oscillograph. The instrument has very little friction, and is aperiodic owing to very strong damping. It is especially adapted for registration of reflected waves or later-arriving refracted impulses. Characteristic curves of the seismograph are given and several sketches illustrate the description.—*S. T. V.*

12024. Hattori, Yasumasa. On the transmission of the shot-instant in seismic refraction method [in Japanese]: Geophys. Exploration, vol. 2, no. 3, pp. 14–15, 1946.

The accuracy of time transmission of various methods is discussed. At the instant when the transmission line around the charge without any current flowing was broken by the explosion, a large electromagnetic force in the broken wire was observed. An arrangement for shot-instant transmission over a single communication line, using a thyratron, is shown.—*M. C. R.*

12025. Clewell, D. H. and Simon, R. F. Seismic wave propagation: Geophysics, vol. 15, no. 1, pp. 50–60, 1950.

Seismic reflection energy is usually in the frequency range of 20 to 100 cycles per second. The general absence of reflected energy below 20 c.p.s. is attributed to the fact that wave lengths in this range are large compared to thicknesses of reflecting bed and are transmitted efficiently, returning to the surface only by refraction. As the frequency increases, wave lengths become comparable to the discontinuities represented by stratification and more efficient reflection takes place. At still higher frequencies absorption and scattering by small irregularities form an effective cut-off. Improvements of the resolving power of the reflection seismograph will probably result from techniques which shorten and simplify the input signal rather than from efforts to widen the band of usable frequencies. Elimination of non-linear displacements in the vicinity of the shot point is an obvious approach.—*M. C. R.*

12026. Morris, George. Some considerations of the mechanism of the generation of seismic waves by explosives: Geophysics, vol. 15, no. 1, pp. 61–69, 1950.

When an explosive is detonated, the walls of the shot hole are subjected instantaneously to pressures of several hundred tons per square inch. This sudden impact on the walls causes a shock wave which spreads out spherically. The initial stresses greatly exceed the strength of the medium and cause fracturing of the ground, but as the pulse moves outward, the stresses decrease and at the critical radius where the stresses just equal the elastic limit, the pulse becomes an elastic pulse. It is then transmitted appreciably unchanged through the ground.—*M. C. R.*

12027. Savitt, C. H. **Reflected energy variations resulting from small changes in shot hole and spread locations**: Geophysics, vol. 15, no. 2, pp. 219–226, 1950.

Examples of seismograms and cross sections are presented to illustrate changes of considerable importance resulting from relatively minor displacements of shot holes and spreads. Records are exhibited from continuous profiling lines which were shot from separate lines of shot holes on opposite sides of a single line of spreads, as well as from lines which were shot from a single line of holes but which were recorded simultaneously on separate parallel spreads. A comparison of the results of conventional spread arrangements and of the parallel line or "H" spread technique as used in difficult areas is made.—*Author's abstract.*

12028. Shock, Lorenz. **The progressive detonation of multiple charges in a single seismic shot**: Geophysics, vol. 15, no. 2, pp. 208–218, 1950.

The relative efficiencies of various sizes of explosive charges for the generation of seismic energy were investigated and a procedure devised whereby a number of charges of the most efficient size would be detonated progressively in such a manner that the energy from all the individual charges would arrive simultaneously at the recording position. The results of investigations of this system of progressive detonations, using both horizontal and vertical spacings of the individual charges, are presented and its possible application in reflection and refraction seismic surveys is discussed.—*Author's abstract.*

12029. Iida, Kumizi. **Rate of changes in elastic wave velocity with pressure [in Japanese]**: Geophys. Exploration, vol. 2, no. 3, pp. 11–13, 1949.

The subject is considered assuming Birch's theoretical treatment based on Murnaghan's theory of finite strain. The rate of change in elastic wave velocity of rocks several hundred meters beneath the earth's surface is less than 1 per cent, but that of rocks with elasticity smaller than 10^9 c.g.s. is 10 per cent or more. These facts must be considered in the interpretation of results of seismic prospecting.—*M. C. R.*

12030. Epinat'eva, A. M. On certain types of diffracted waves recorded on seismograms [in Russian]: Akad. Nauk SSSR Izv., Ser. geog i geofiz., vol. 14, no. 1, pp. 89–95, 1950.

During seismic exploration of several areas in southern U. S. S. R., waves which had been diffracted over a portion of their path were discovered on the seismograms. This diffraction is attributed to the presence of limestone layers at depths of 0.5–10 meters. Diffracted waves in turn give rise to other waves, such as Mintrop waves. The appearance of diffracted waves instead of ordinary Mintrop waves is most often associated with an abrupt reduction of intensity and a decrease in the frequency of vibrations. Body waves and surface Mintrop waves were identified among these diffracted waves. Where diffracted waves show greater intensity, the refracting boundaries of limestone strata were nearer the surface and nearer to each other. When the refracting boundaries are deeper, no diffracted waves can be detected on the seismograms because of their rapid attenuation with increasing distance.—*S. T. V.*

12031. **Krey, Theodore. Zur Frage der Anerkennung und Bewertung von Reflexionen [The recognition and evaluation of reflections]: Erdöl u. Kohle, 3d Jahrg., Heft 1, pp. 14–16, 1950.**

In seismic prospecting it often becomes quite difficult to determine the nature of certain indications obtained from the seismograms. An objective method is presented, based on the theory of probability in evaluating such characteristics of seismic phenomena as the phase relationships of different waves, the ratio of their amplitudes, and similar data. If the computed probability of the coincidence of certain characteristics is 10 per cent or less, it can be concluded that the identity of these characteristics is the result of a causal relation. If this probability is found to be over 50 per cent, the events are considered not related. The method is inconclusive if the probability is between 10 and 15 per cent. Several examples are presented from seismic reflection surveys.—*S. T. V.*

12032. Krouskij, L. Bestimmung des wahren Einfallens und der wahren Tiefe reflexionsseismisch ermittelter Schichten [Determination of the slope and true depth of layers from seismic reflection data]: Erdöl u. Kohle, 2d Jahrg., Heft 11, pp. 489–490, 1949.

A graphic method of determining the slope and the depth of a reflecting horizon from the data obtained by star shooting is presented. For the geometrical construction involved at least four points of observation are necessary and the velocity of propagation of the seismic waves must be known.—*S. T. V.*

12033. Ricker, Norman and Lynn, R. D. Composite reflections: Geophysics, vol. 15, no. 1, pp. 30–49, 1950.

A method of reflection prospecting has been developed based on use of the *PS* phase, a disturbance which has traveled from the shot to the reflecting bed as a dilatational wave and from the reflecting bed to the earth's surface as a shear wave. The phase is found in the otherwise quiet region between dilatational waves and ground roll, is often outstanding in simplicity and prominence, and may be correlated from hole-to-hole and spread-to-spread. Test surveys in the Homer and Cotton Valley area, Louisiana, were made to evaluate the method. Two methods of interpretation were used, an empirical method depending on knowledge of the depth of the reflector at certain control stations from well logs or other data, and a rational method which involves determination of wave velocities and approximate depth of reflector from refraction studies. The composite reflection method seems to be applicable in regions where an unconsolidated layer extends downward from the surface to a single hard bed serving as a reflector.—*M. C. R.*

12034. Poulter, T. C. The Poulter method of geophysical exploration: Geophysics, vol. 15, no. 2, pp. 181–207, 1950.

The techniques involved in use of the method are described. *See also* Geophys. Abstract 11539.—*M. C. R.*

12035. Poulter, T. C. The Poulter seismic method: Canadian Min. Met. Bull., vol. 43, no. 457, pp. 259–267, 1950.

A complete description of the method is given. (*See also* Geophys. Abstract 11539). During the summer of 1949 seismic studies using this method were undertaken on the Taku Glacier. Longitudinal, transverse, and Rayleigh waves were identified on the records. Velocities of these in the solid blue ice were 12,900, 6,620, and 5,800 ft./sec. respectively, and the velocity of longitudinal waves in névé was 3,600 to 5,000 ft./sec. Four lines of stations were occupied from which it was possible to construct vertical cross sections of the glacier.—*M. C. R.*

12036. Slotnick, M. M. A graphical method for the interpretation of refraction profile data: Geophysics, vol. 15, no. 2, pp. 163–180, 1950.

A graphical method for interpreting refraction profiles which has been used for many years, is consistent with the accuracy of the data, and which has met with success in its application and results is outlined and illustrated. The procedure is as follows. O and O' are the shot points. The line OQ is drawn at an angle α with the vertical in which α is $\sin^{-1} v_1/v_{2u}$. The first section of the time-distance curve through O or O' defines v_1 and the slope of the second segment of the time-distance curve through O' gives $1/v_{2u}$. The line $O'Q$ is similarly drawn at an angle α' with the vertical where α' is $\sin^{-1} v_1/v_{2d}$, v_1 being the same as above and $1/v_{2d}$ the slope of the second section of the time-distance curve through O. The angle of dip is $\phi=(\alpha'-\alpha)/_2$, and the critical angle of the interface $\theta=(\alpha+\alpha)/2$. The point P is determined so that QP equals QO, and $\tau=O'P/v_1$ is computed, $O'P$ being found by scaling. The difference $t=T-\tau$ in which T is the travel time O *to* O' is found, and then $a=(v_2t-d)/2(v_2/v_1-v_1/v_2)$, in which d is the scaled-off distance OP, is computed. The points A and A' are found by scaling so that $OA=PA'=a$, and the line AA' is the trace of the desired interface.—*M. C. R.*

12037. Agocs, W. B. Computation charts for linear increase of velocity with depth: Geophysics, vol. 15, no. 2, pp. 227–236, 1950.

Computation charts are presented which reduce or eliminate calculations of correlation and wave-front depth charts. A series of depth charts are made for particular values of the velocity increment solving the time-depth relation for all possible initial velocities of the equation $y=(V_0/k)(e^{kt}-1)$. From these charts, the average velocity-depth curves are obtained, and also the velocity function to be used on a project determined from velocity shooting by comparison to the theoretical average velocity-depth curves. For wave-front depth charts, a series of families of curves are plotted for the full range of velocity increments and all initial velocities for the equations of the instantaneous center of the wave front, $z=(V_0/k)(\cosh kt/2-1)$, and the radius of the wave front, $r=(V_0/k)(\sinh kt/2)$. The relation between k and $e^{kt/2}$ for a range of times is plotted, and therefrom a value of $e^{kt/2}$ obtained for the particular velocity increment for the solution of the equation $\tan \Theta/2=\tan \Theta_0/2\cdot e^{kt/2}$. Finally, curves for a series of $\tan \Theta/2$ against initial velocity curves are plotted for a series of step out times, and therefrom the value of $\tan \Theta/2= \tan \Theta_0/2\cdot e^{kt/2}$, or the angle of dip, Θ, is obtained. This latter family of curves can be used to determine the variation of dip with variation in initial velocity in highly folded areas. The latter set of curves is useful for the construction of a time-step-out time-dip-depth-offset chart which is used for direct plotting of offset-depth-dip positions of reflecting horizons, or as a trace-analysis underlay chart.—*Author's abstract.*

12038. Rice, R. B. A discussion of steep-dip seismic computing methods, Pt. 2: Geophysics, vol. 15, no. 1, pp. 80–93, 1950.

Comparison of several commonly used steep-dip seismic computing methods (*see* Geophys. Abstract 11090) has been extended to the case of a second parabolic velocity function considerably "faster" than that previously used, and to the computation of the profile of a reflecting horizon through a fault zone. Two other straight path methods which assume that the isovelocity layers are parallel to the reflecting horizons and three purely mathematical methods designed to produce certain results and not readily interpretable from a physical standpoint are also considered. It is concluded from these studies that it is possible to formulate workable computing methods to produce any desired results but that there is not yet sufficient data from steep-dip areas to establish any one method as superior to all others from an empirical point of view.—*M. C. R.*

12039. Hazebroek, P. Note on the analysis of oblique reflection data: Geophysics, vol. 15, no. 1, pp. 70–79, 1950.

The inclination and vertical plane of the ray at the surface can be determined from the time differences observed on two seismograph spreads laid out to form a cross. If the distance between shot point and center of spread, total travel time, and velocity distribution are known, a unique solution for the depth of the reflection point and the dip and strike of the reflecting layer is possible. A rigorous geometrical solution of the problem is given, assuming a linear increase of velocity.—*M. C. R.*

12040. U. S. Waterways Experiment Station. Critical study of shallow seismic exploration in the limestone areas of the Ozark Highlands: Tech. Mem. 199–1, 69 pp., 1943.

The detailed results of foundation exploration by boring and seismic refraction methods at several proposed dam sites in the limestone regions of the Ozark Plateau are reported. At some sites, weathering was characterized by deep overburden and thick zones comprised of rock pinnacles and clay-filled fissures; at other sites the weathering was less deep and the transition zones between overburden and sound rock were relatively thin. At all sites fresh rock was near the surface in the stream bed, and the flood plains consisted of alluvial silts, sands, and gravel.

From this study the conclusion is drawn that in deeply weathered limestone regions, seismic exploration will not yield definite depths to firm rock, nor can the seismic refraction method identify cavernous conditions below apparently sound rock. In areas where the weathering of the limestone is shallow and in the flood plains, seismic exploration is considered satisfactory and usable, since the rock depths are in close correlation with those shown by borings.—*S. T. V.*

12041. U. S. Waterways Experiment Station. Seismic and resistivity exploration methods: Tech. Mem. 198–1, 85 pp., 1943.

Comparative tests of the seismic refraction and electric resistivity methods of geophysical exploration of subsurface conditions in the alluvial valley of the Mississippi River were made near Marion, Ark., Round Lake and Rolling Fork, Miss. At each of these sites, the materials composing the alluvium and the top of the underlying Tertiary formations were known from borings.

Of the twelve seismic refraction profiles obtained, only two yielded data from which the depth to Tertiary formations could be accurately determined. For the other ten profiles the seismic velocity in the overlying saturated alluvium was almost equal to that in the topmost Tertiary materials, thereby rendering the data uninterpretable. The seismic method is thus not suitable for use in the alluvial valley of the Mississippi.

Of the fifteen electric resistivity profiles which were situated close to borings, the depth to Tertiary formation was determined with an average error of ±11 percent, in comparison with borings depths. The results of the resistivity method, therefore, are considered to be adequate for the purposes of engineering problems concerned with determining suitable locations for levees, combating underseepage at levees, and in general for planning improvements in which depth and composition of alluvium are important considerations.—*S. T. V.*

ELECTRICAL METHODS

12042. Jemma, Raimundo. La geofísica aplicada a la téchica [Geophysics applied to industry]: Industria Minera., no. 97, pp. 24–27, 1950.

This is a brief summary of geophysical prospecting by electrical methods as applied to prospecting for oil and minerals, or for investigations of geological structure near dam sites or around important industrial buildings.—*S. T. V.*

12043. Kiyono, Takeshi and Ito, Junji. A contribution to the theory of electro magnetic prospecting [in Japanese]: Geophys. Exploration, vol. 2, no. 2, pp. 1–4, 1949.

The magnetic field due to a point-current-source placed on the earth's surface was considered, and the isodynamic lines on a plane of finite height above the surface were obtained.—*M. C. R.*

12044. Enenstein, B. S. Electromagnetic processes in circuits employed in prospecting by electrical methods [in Russian]: Akad. Nauk SSSR Izv., Ser. geog. i geofiz., vol. 13, no. 5, pp. 434–439, 1949.

If a cable, grounded at both ends, receives at its midpoint an impulse of rectangular wave shape, the current flowing into the cable and through it into the ground increases from zero to a final value in a very short time, after which a direct current is established. In spreading through the ground the impulse changes its rectangular wave shape. The time interval τ, elapsing until at a certain point of the ground the current reaches its maximum, can be represented by Tikhonov's formula $\tau=0.314x^2/S$, where x is the distance in kilometers of the point in the ground from the feeding electrode, and S the specific resistivity of the ground in ohm-meters.

The rectangular impulse sent into the cable is produced by a thyratron generator. The time until the current reaches its maximum is about 10^{-7} sec.

Electrical processes taking place in different members of the measuring apparatus were investigated theoretically and experimentally and it is concluded that the value of the specific resistivity of the ground obtained in these measurements is often affected by serious errors. To obtain the correct values of the resistivity the following precautions are to be followed: the feeder line must have an independent switch, readings of the potential value must be made only after the lapse of an interval not less than 5, sometimes 10 seconds, in accordance with the resistivity of the ground and the spread of electrodes. The ground is not a linear conductor, as is often assumed, and therefore an induced electromotive force in it cannot be neglected.—*S. T. V.*

12045. Niem, G. de Das elektrische und magnetische Feld einer punktformigen Stromquelle [Electrical and magnetic field of a point source]: Beitr. angew. Geophysik, Band 10, Heft 3–4, pp. 265–272, 1943.

Electrical and magnetic fields produced on the earth's surface by a point source placed on surface are determined. The earth is considered as a homogenous conducting semispace, and the point source is represented by a metallic hemisphere with dimensions which are small compared to the distances considered. If direct current is considered, the electric field produced at any point is determined by the potential at this point, and the magnetic field is derived from Maxwell's fundamental equations. For alternating current, a differential equation in polar coordinates is derived for the electromagnetic conditions produced at a point. Solutions of this equation are given for the steady, quasi-stationary, and the transient states. In the last, the amplitude of the wave equation is represented in a complex form. Use of polar coordinates makes it possible to apply this method to a stratified medium.—*S. T. V.*

12046. Semenov, A. S. The theory of the method based on charged bodies applied to equipotential conductors [in Russian]: Vses. Nauchno-Issled. Geol. Inst. Geofiz., no. 13, pp. 3–56, 1948.

In many electrical prospecting methods it is important to have at least the approximate picture of the field patterns generated by unknown bodies of different shapes. Field patterns forming around the following bodies are computed and presented in form of graphs and tables: sphere, linear conductor stretched parallel to the ground, elongated and flattened ellipsoids of revolution, rectangular plate placed parallel to the earth's surface.

Equations of the potential function for the above cases are given, as well as the values of the gradients along certain characteristic lines, such as the axes of symmetry. The final section gives deviations of the computed results from those obtained for bodies slightly differing in shape from the assumed.

Master charts and tables of characteristic values as functions of the geometric parameters of the bodies under consideration are included.—*S. T. V.*

12047. Tikhonov, A. N., and Mukhina, G. V. Determination of alternating electrical field in a stratified medium [in Russian]: Akad. Nauk SSSR Izv., Ser geog. i geofiz., vol. 14, no. 2, pp. 99–112, 1950.

An analysis is presented of an alternating electrical field generated by a point dipole in a layer of depth l, with electrical conductivity σ, overlying nonconductive semispace. This is analogous to a dipole placed on the earth's surface in a region where the upper layer of the ground is conductive and the underlying formations are nonconductive. Boundary conditions for the Maxwell equations of the unknown field are that the field intensity near the dipole is that of the dipole, and the field intensity at infinity is zero. Variation of the tangential components of the electrical and of the magnetic vectors is continuous. It is also assumed, as the general property of the field, that the intensities of the current I_0 and of the electrical and magnetic fields are represented by expressions containing the factor e^{-iwt} where t is time, and w the frequency of the pulsations. The solution of the differential equations is expressed in cylindrical coordinates. Graphs representing the variation of the amplitude and the phase of the electrical field with distance from the dipole are given for several values of *l*.—*S. T. V.*

12048. Yüngül, Sulhi. Interpretation of spontaneous polarization anomalies caused by spheroidal bodies: Geophysics, vol. 15, no. 2, pp. 237–246, 1950.

The theoretical spontaneous polarization anomaly of a conducting sphere buried in a homogeneous and isotropic earth is analyzed mathematically, and a method is derived for determining the location, depth and dip of spheroidal ore bodies. The equipotential lines of the field data are smoothed and profiles are taken parallel to the straight line between positive and negative centers. The loci of the zero points and the loci of the minimum points intersect this line in points from which the desired quantities can, with the aid of accompanying graphs, be readily determined. Because of electrocapillary action and telluric potentials, topographic corrections are necessary when the surface has a steep slope. A regional potential, which is due to telluric currents, is corrected in a similar manner to that used in gravity interpretation. Examples are given in which the method is applied to two observed spontaneous polarization anomalies.—*R. G. H.*

12049. Schenk, Erwin. Zur Bedeutung und Auswertung von Unstetigkeiten in Diagrammen geoelektrischer Vertikalsondierungen [The importance and the interpretation of discontinuities in diagrams obtained in geoelectrical deep exploration]: Beitr. angew. Geophysik, Band 10, Heft 3–4, pp. 287–307, 1943.

The necessity of changing the position of the electrodes in exploring deep formations by electrical-resistivity methods often results in discontinuities in the recorded curves. Such discontinuities are usually eliminated by extending separate branches of the recorded curves parallel to the corresponding portions of adjoining curves, and the resulting composite curve is used as the basis for interpretation of field data. This procedure frequently leads to contradictions and errors. An investigation in connection with the detailed electrical exploration of an area around a dam site, well explored geologically, indicated that these discontinuities in the diagrams may be produced by changing the depth of the potential electrodes, by changing their distance apart, by changing the current electrode separation, or by the presence of structural discontinuities underground.

Changing the depth of the electrodes from 0.3 to 2 meters, always assuring a good electrical grounding, resulted in discontinuities in the diagrams which could not be eliminated by translation or extension of individual curves. The same effect was observed when the separation of the potential electrodes was changed. Discontinuities caused by increasing the separation of the current electrodes, however, can be eliminated by a translation of the individual curves.

Schenk concludes that Wenner's procedure combined with changes in electrode separation, will result in errors whenever there are inhomogeneities of the ground and recommends use of Schlumberger's scheme. He also recommends that no change be made in the electrode position and the use of a ratio of potential to current electrode separation up to 1/60. If a change becomes necessary it is advisable to repeat measurements at several points of the former arrangement.—*S. T. V.*

12050. Schenk, Erwin. Über den Einfluss von Schollengrenzen auf geoelektrische Vertikalsondierungen [On the influence of boundaries between layers on vertical electrical soundings]: Beitr. angew. Geophysik, Band 11, Heft 1, pp. 83–102, 1944.

The influence of subsurface stratification on the results of vertical geoelectrical sounding is studied. Faults are indicated as discontinuities and changes of curvature in the diagrams. This may lead to erroneous interpretation of the measurements because the curves are then typical of multiple stratification when in reality the measurements encompass only two or three layers. A procedure is given for eliminating these discontinuities and interpreting correctly the diagrams. Near-surface inhomogeneities produce a curve of a new type when the distance between the measuring electrodes is increased, whereas a greater spacing of feeding electrodes results in a displacement of the graph. The determination of the depth is contingent on the position of the electrodes. In general three types of diagrams can be obtained in vertical sounding. The proposed method makes possible not only determination of the depth of horizontal strata but also indicates the possible location of other buried electrically-conductive bodies.—*S. T. V.*

12051. Kiyono, Takeshi. Theoretical study on the ground resistivity method of electrical prospecting: Kyoto Univ. Fac. Engineering Mem., vol. 12, no. 2, pp. 29–59, 1950.

Wenner's electrode arrangement is analyzed and the resistivity curve is determined theoretically for the constant-depth profile. The two-dimensional approximation is adopted and the theory of functions of complex variable is applied. This makes it possible to transform the boundary of the ore body to a simpler one and in many cases the potential can be easily calculated. The following cases are analyzed: the ore body is a perfect conductor or perfect insulator and has the shape of a semi-infinite plate of given thickness lying at a known depth; the ore body is a similar semi-infinite plate buried in a vertical position; the ore body is a thin horizontal or vertical plate of finite dimensions; the ore body is a circular cylinder, either a perfect conductor or a perfect insulator; the ore body is a circular cylinder with finite conductivity; the disturbing body is an anticline or a syncline.—*S. T. V.*

12052. Makino, Naofumi. On the apparent resistivity curves for underground layered structures [in Japanese]: Geophys. Exploration, vol. 2, no. 3, pp. 18–21, 1949.

A new explanation is proposed for apparent resistivity curves which have abrupt breaks. An abrupt change in the resistivity is presumed to take place when the potential drop between two points on the interface exceeds a definite threshold voltage like the decomposition voltage of water. Field data indicate the new theory to be satisfactory. Apparent resistivity curves when the electrodes are arranged at the bottom of a river were derived using the Bessel function. Numerical examples were calculated and found to be in good agreement with field data.—*M. C. R.*

12053. Kiyono, Takeshi, Inagaki, H., and Shibata, B. Resistivity curves for semi-circular disc [in Japanese]: Geophys. Exploration, vol. 2, no. 3, pp. 16–17, 1949.

The apparent resistivity curves for Wenner's electrode system when a perfectly conducting or insulating semicircular disc is buried in a vertical position, were computed. These curves were compared with theoretical curves obtained by one of the authors and satisfactory coincidence between the two was found.—*M. C. R.*

12054. Kurata, Nobuo, Ochiai, Toshiro, and Murashita, Toshio. Electric resistivity curves as the index of geological conditions [in Japanese]: Geophys. Exploration, vol. 2, no. 3, pp. 26–29, 1949.

A description is given of geological conditions for which resistivity curves obtained by the Lee method in prospecting for underground water show distinguishable and characteristic forms.—*M. C. R.*

12055. Sato, Konosuke. On the "mean" 3-electrode method [in Japanese]: Geophys. Exploration, vol. 2, no. 2, pp. 5–6, 1949.

Various electrode spacings and configurations may be employed in resistivity methods. The "mean" 3-electrode method is proposed in this paper. ρ_{123} is the apparent resistivity of three electrode spacings which are so arranged that the power electrode C_1 and the potential electrodes P_1 and P_2 are three points (1, 2, 3) on a straight line and the power electrode C_2 is at infinity. ρ_{321} is the apparent resistivity of three electrode spacings which are arranged C_1, P_1, and P_2 at three points (3, 2, 1).

The $\rho_{123}=4\pi a\ (V_{12}-V_{13})/I$ and $\rho_{321}=4\pi a\ (V_{32}-V_{31})/I$. The apparent resistivity of the "mean" 3-electrode is defined as $(\rho_{123}+\rho_{321})/2=2\pi a\ (V_{12}+V_{32}-2V_{13})/I=\rho_{12}(a)+\rho_{32}(a)-\rho_{13}(2a)$ where $\rho_{12}(a)$ is the apparent resistivity of two electrode spacings at points 1 and 2 and $\rho_{13}(2a)$ is the apparent resistivity of two electrode spacings at point 1 and 3. By this method, the effect of underground irregularities near both side electrodes is decreased.—*M. C. R.*

12056. Nakabayashi, Kazutaka. Generating mechanisms of spontaneous polarization: (2) Some examples in Manchuria [in Japanese]: Geophys. Exploration, vol. 2, no. 3, pp. 22–25, 1949.

Summarizing the results of spontaneous polarization surveys in 35 districts in Manchuria, the author finds that all massive bodies or continuous veins of pyrite, pyrrhotite, chalcopyrite and graphite give a strong spontaneous polarization potential, and ore bodies of galena, stibnite, and manganese ores sometimes produce a potential not so strong but sufficient for exploration.

In natural sulfide ore bodies, the H ions and the HS ions in the surrounding water are supposed to have an important role in the generation of spontaneous polarization. Some impregnation deposits of pyrite show very strong spontaneous polarization potential, and sometimes remarkable anomalies are found even in oreless zones.

Distributions of potential difference measured at the surface may be attributed not only to oxidation and reduction of ore bodies but also to electrochemical actions between the ore body and underground water, polarization potentials resulting from differential concentration of ions in water near the mineralized zone, streaming potential of underground water passing through the capillary pores of the rocks, and polarization potential resulting from differential concentration of ions in water affected by the rocks.—*M. C. R.*

12057. Chang, T. H. Application of Wenner's method: Chinese Geophys. Soc. Jour., vol. 1, no. 2, p. 228, 1949.

The Wenner method, with electrode spacing of 50 meters, was used to determine the depth of Quaternary gravel overlying Tertiary rocks in Laochunmiao oil field, taking advantage of the sharp difference in resistivity (190 ohm-meters for the gravel, 15 ohm-meters for the Tertiary). Certain difficulties resulted from irregularities of the contact and the rugged topography, but a definite relation was established between the measured apparent resistivity and the thickness of the gravel determined by drilling. Graphs of the results computed from Roman's tables and the results of drilling are included.—*S. T. V.*

12058. Spicer, H. C. Investigation of bedrock depths by electrical resistivity methods in the Ripon-Fond du Lac area, Wisconsin: U. S. Geol. Survey Circ. 69, 37 pp., 1950.

Resistivity measurements were made in east-central Wisconsin, chiefly Fond du Lac County, to determine depths to bedrock, using the Earth-Resistivity Apparatus, a modification of the Gish-Rooney instrument. Depth profiling was used with the Lee electrode configuration. Depths to pre-Cambrian rocks, identified by their higher resistivity, determined by this method range from 355 to more than 1,000 feet, and in general were in good agreement with those found by drilling. Field measurements indicate that with favorable surface conditions resistivity methods may be used here to locate pre-Cambrian rocks to depths of about 1,500 feet.—*M. C. R.*

12059. Goguel, Jean. Essai d'interpretation de la prospection géophysique de la Bresse et du Bas Dauphiné [A tentative interpretation of the geophysical survey of Bresse and Bas Dauphiné]: Bur. Recherches géol. et géophys. Pub. 6, 79 pp., 1948.

A geophysical survey, including gravimetric and electrical measurements, was made in the provinces of southeastern France. Gravimetric measurements were made by the Thyssen gravimeter with a density of one station to 5 sq. km. and precision of determinations about 1 mgal. The central part of Bresse was explored also by a torsion balance. Electrical exploration was by the potential-profile method and, in regions around metallic outcrops, by resistivity measurements. The supposed Oligocene depression extending from Alès to the Swiss plateau must be rejected as contrary to findings of the survey, but no substitute theory can be proposed at the present. Numerous examples of the analysis of geophysical data from the geologic point of view, illustrated by detailed maps, diagrams, and profiles are included.—*S. T. V.*

RADIOACTIVE METHODS

12060. Hatsuda, Zin'ichiro. On the radioactive exploration [in Japanese]: Geophys. Exploration, vol. 2, no. 3, pp. 1–5, 1949.

A review of radioactive exploration, including description of methods and apparatus and discussion of the effects of moisture, temperature, and atmospheric pressure.—*M. C. R.*

12061. Stead, F. W. Prospecting for uranium with portable Geiger-Müller equipment: Upper Peninsula of Michigan Mineral Industries Conference, Michigan Coll. Min. and Technology, Conference on radioactive ores, May 6, 1949, pp. 27–28.

The Geiger-Müller counter is the most reliable prospector's tool in searching for uranium ores. Radioactive elements can be identified by several methods, using the detection of alpha, beta, or gamma rays, the most favorable being the counting of gamma rays. This method, however, requires comparison of the unknown material with known standards. Use of an ionization chamber or of the proportional counter requires a more sensitive amplifier and presents difficulties in insulating the detector because of high input resistance. To obtain dependable results in the field the Geiger counter must be tested often by using a standard sample. It should be borne in mind that gamma rays cannot penetrate any considerable thickness of solid materials. About 50 percent of the gamma radiation from a radioactive ore originates in the outer two inch layer of the ore.—*S. T. V.*

12062. Kemp, C. E. Geiger counter reconnaissance in Upper Michigan: Upper Peninsula of Michigan Mineral Industries Conference, Michigan Coll. Min. and Technology, Conference on radioactive ores, May 6, 1949, pp. 25–26.

Investigations with a Geiger counter on the western half of the Upper Peninsula of Michigan in search for uranium ores are briefly reported. The instrument was also found to be useful in correlating and distinguishing various types of rocks. It is suggested that the Geiger counter can be used not only in prospecting for uranium but also for rapid geological reconnaissance work in general.—*S. T. V.*

12063. Almeida Rolff, P. A. M. de. Minerais radioativas, notas sôbre sua prospecção. [Radioactive minerals, notes on prospecting for them]: Rev. da Escola de minas, vol. 14, no. 9, pp. 13–15, 1949.

The article gives a short description of different methods of prospecting for uranium or thorium containing minerals. Methods based on fluorescence, scintillation, radioactivity are described as well as their application in different regions of Brazil.—*S. T. V.*

12064. Lutz, W. Die Schnellanalyse von Kaliflötzen durch gamma-strahlungsmessung mit Zählrohren in Horizontalbohrungen unter Tag [The rapid analysis of potassium deposits by gamma-radiation measurements using counters in horizontal drill holes underground]: Beitr. angew. Geophysik., Band 10, Heft 3–4, pp. 273–286, 1943.

A method is described of determining the K_2O content of a potassium deposit by using a Geiger-Müller counter. The number of impulses produced by gamma radiation of a deposit is shown to be proportional to the average K_2O content in a sphere of about 56 cm. radius surrounding the counter.

Experiments demonstrated such measurements to be in good agreement with the results of chemical analyses. A standard Geiger counter with a tube of about 35 mm. diameter and 320 cm. length was employed in these experiments, and K_2O contents ranging from a fraction of one percent to 62 percent measured.

The method can be applied only when the deposit is free of other sources of gamma rays, such as radium or thorium salts.—*S. T. V.*

12065. Lutz, W. Die Schnellanalyse von festen und flüssigen Kaliproben durch gamma-strahlungsmessungen mit Zählröhren über Tag [Rapid analysis of solid and fluid samples containing potassium by measuring overground the gamma radiation with a counter]: Beitr. angew. Geophysik., Band 11, Heft 1, pp. 55–72, 1944.

If measurements of potassium content are made in a drill hole, the impulse number read on the gamma counter is proportional only to the potassium content of the surrounding formation. The same measurement, made above ground, results in a reading which can be correctly interpreted only by using an empirical formula containing the density of the sample, which is often unknown. A theoretical relationship is derived, replacing the empirical formula, and confirmed on nine samples, each weighing 30 kg. The error of the determination may be as low as ±0.5 percent of K_2O with a duration of the measurement of 16⅔ minutes. This error can be decreased to 0.25 precent with 20 minutes measuring time. The theory of the method is presented and the counter employed is described.—*S. T. V.*

12066. Lesage, M., Rogozinski, A., and Voisin, A. Sur la construction des compteurs Geiger-Müller du type metallique [Construction of Geiger-Müller counters of all-metal type]: Jour. Physique et Radium, vol. 10, no. 6, pp. 212–214, 1949.

A Geiger-Müller counter of exceedingly simple design and construction, especially adapted for field work, is described. The principal tube is made of a cylindrical drawn brass pipe 1 mm. thick, the axial wire is of tungsten 0.1 mm. in diameter, and a mixture of alcohol and argon is used as filling gas. Nickel or copper may be used for the tube, and molybdenum or stainless steel for the wire. Details of the manufacturing procedure are given.—*S. T. V.*

12067. Brownell, G. M. Radiation surveys with a scintillation counter: Econ. Geology, vol. 45, no. 2, pp. 167–174, 1950.

A portable scintillation counter for rapid and accurate measurements of radiation intensities has recently been developed and tested. The instrument is about one hundred times more sensitive than portable Geiger counters.

On the basis of data from radiation surveys over pitchblende deposits in the Lake Athabaska region, maps were made showing "isorads" or zones of equal radiation intensity in units of 5×10^{-4} milliroentgens per hour, which provided a pattern of the vein system and located new veins.—*S. T. V.*

12068. Kolmogorov, A. N. Determination of the coefficient of thermal diffusivity of the soil [in Russian]: Akad. Nauk SSSR., Ser. geog. i geofiz., vol. 14, no. 2, pp. 97–98, 1950.

A method is presented for determining the coefficient of thermal diffusivity of soil from observations of temperature, corresponding to four moments of time, at two points of different depths. Results obtained by this method are more reliable than those from determination of the phase displacement of the temperature waves, varying with depth. The determination of the wave form becomes very unreliable because of the rapid decrease of the temperature variation.

The proposed method is based on the expression of the amplitude of temperature wave, varying exponentially with the depth of the point. Harmonic variation of the temperature with a period of 24 hours is assumed.—*S. T. V.*

WELL LOGGING

12069. Tainsh, H. R. Tertiary geology and principal oil fields of Burma: Am. Assoc. Petroleum Geologists Bull., vol. 34, no. 5, pp. 823–855, 1950.

The chief Tertiary geological features of Burma and the geological history of the period as indicated by stratigraphical and structural evidence are summarized. The Chauk and Lanywa oil field, which are on one major dome but separated by the Irrawaddy, and the Yenangyaung field are described.

In both areas Schlumberger resistivity and self-potential surveys were used for detailed correlations between wells, and for fixing the depths and throws of the various faults. It was not found possible to use the resistivity logs to give any indication of the fluid content of the sands, in part because of the low salinity of the formation water, and the thinness of the sands. A reduction of resistivity of one sand downdip, recently noted, is presumably due to an increasing connate water content and is being further investigated.

The average temperature gradient in the Yenangyaung field as measured with the Schlumberger recorder is 1° F. per 100 feet with a temperature of 115° F. at 3,000 feet.—*M. C. R.*

12070. Spradlin, V. E. The relation of the initial production to true resistance in the Southeast New Castle field, Cleveland and McClain Counties, Okla.: Oklahoma Acad. Sci. Proc., vol. 29, pp. 45–49, 1950.

The purpose of this paper is to determine whether the true resistivity value alone could be used in determining the initial production from the limestone reservoirs in the Southeast Newcastle field. To obtain the true resistivity of the producing formation the method outlined by H. Guyod was used and the results were compared with statistical data on the initial productivity of ten oil wells of this field. It is concluded that no direct relations can be established between the true resistivity and production. Wells with the lowest resistivity may be dry in one case and fairly good producers in another. Similarly one well with a true resistivity of 937 ohm-meters was dry, another with 950 ohm-meters had the initial production of 531 barrels. Only a certain tendency can be established for higher initial production to be associated with higher resistivity values.—*S. T. V.*

12071. Milne, W. P. Relation of electric log resistivities in limestone to oil production: Oklahoma Acad. Sci. Proc., vol. 29, pp. 50–56, 1950.

The correlation between the productivity of a well drilled in limestone and the deviations from the apparent parallelism of the second and third resistivity curves on electrical log diagrams is studied. The chief factors causing such deviations are the effect of the contact between two different formations on the electric log, mud invasion, and the chemical composition of the fluid in the formation, salt water tending to give a negative deviation, and oil a positive one.

For the study of this relationship a special function is introduced equal to the average deviation divided by the square root of the difference of the average square of the deviation and the deviation squared.. Computing this function for the Phillips no. 2 Kosar well 4–14N–4W of the West Edmond pool, Mississippi, figures were obtained which were well within the limits of the necessary accuracy. It is concluded that the suggested method of investigation has unlimited possibilities making possible future prediction of the fluid content in advance of drilling.—*S. T. V.*

12072. Ray, H. W. Radioactivity well logging proves effective in the northern Colorado-southern Wyoming area: Tomorrow's Tools Today, vol. 16, no. 1, pp. 28–32, 1950.

Radioactivity logs in the northern Colorado and southern Wyoming area have proved reliable and both gamma ray and neutron curves are being extensively used to provide information on formation thickness, extent of possible porous zones, relative amount of porosity, and position of casing with respect to formation. Close correlation was found between the radioactivity log and the core analysis. Examples of the interpretation of radioactivity logs from different wells and their correlation with logs obtained by other methods are given.—*S. T. V.*

12073. McGaha, S. W. Radioactivity well logging moves north to Canada's fields: Tomorrow's Tools Today, vol. 15, no. 4, pp. 28–33, 1949.

Radioactivity well logging is now used in the development of the oil producing areas of western Canada. Drilling difficulties are overcome by the valuable formation data provided, after the casing has been set, by gamma ray and neutron curves. The sandstones, limestones, and shales, together with the dense, low fluid zones, can be easily identified by this means and the curves correlated with electrical logs, drilling time, core analyses, and lithological information. Ten pairs of gamma ray and neutron curves with parallel interpretation of their peculiarities on the basis of exploration results are described.—*S. T. V.*

12074. Campbell, O. E. A method of prospecting for Kansas "shoestrings": World Oil, vol. 129, no. 5, pp. 62–64, 1949.

Analysis of fluorologs of both a producing well and an adjacent dry hole in Anderson County, Kans. suggests a systematic method of exploration for "shoestring" fields. The fluorolog of the producing well showed an average oil intensity of 1 blau and a mineral intensity of 50 blaus down to the producing sand while the dry hole log showed 18 and 32 blaus respectively. Detailed analysis of the data showed the excess mineralization was of secondary origin indicating the presence of a plug which blocked direct ascent of seepages, deflecting them to side paths. The presence and general location of shoestring accumulations can be determined from samples taken from a depth of 4 feet, but for detailed mapping, shallow holes 10 to 50 feet deep may be fluorologged—*M. C. R.*

TECHNICAL AIDS

12075. Müller, Max. Ein Prazisionszeitskalenschreiber mit dekadischer Frequenzunterteilung für Zeitmarkierung und Frequenzmessung [An accurate time recorder with decimal subdivision of frequencies for the recording of time and measurement of frequency]: Geofis. Pura e Appl., vol. 15, fasc. 3–4, pp. 220–226, 1949.

Precise measurement of frequency is of prime importance in surveying by electrical methods when using alternating current of low frequency. A new method of accurate measurement and recording of electrical frequency, is described. The apparatus employed consists of a time recorder with decimal frequency subdivisions in five steps. Its oscillating circuit contains a thyratron, synchronized by a timing fork, with impulses produced in zero points, which increases the precision of the instrument. The oscillation wave is recorded photographically, and the corresponding time interval is registered simultaneously on the same film. The range of the scale can be adjusted to 0.001, 0.01, 0.1, 1.0, and 10 seconds.

Descriptions of the various component parts of the installation, wiring diagrams and graphs characterizing the instrument are given. The apparatus has been constructed for field use, and is sturdy and easily transportable.—*S. T. V.*

12076. Guerra Peña, Felipe. Introducción a' la fotogeologia [Introduction to photogeology]: Assoc. Mexicana Geologos Petroleros Bol., vol. 2, no. 1, pp. 55–70, 1950.

Photogeology or aerophotostereogeology is defined as the complex of methods used for geological interpretation of photographs taken from the air. This is especially valuable in inaccessible regions covered with forests or snow as it eliminates much topographic work and makes possible obtaining a general picture of the area without great loss of time and money. Another advantage is its freedom from restrictions often imposed by the owners of the properties involved. A brief description of the techniques employed in the field and in the photographic laboratory is given.—*S. T. V.*

12077. Glenn, Alfred H., and Bates, Charles. The meteorological and oceanographic aspects of geophysical prospecting: Geophysics, vol. 15, no. 2, pp. 247–256, 1950.

Short-range forecasts of weather and wave conditions in specific areas can now be made with considerable accuracy. The application of oceanography to the study of modern and ancient reefs, strandlines, and stratigraphic traps is suggested.—*H. R. J.*

PATENTS

GRAVITY METHODS

12078. Stabilized vertical pendulum. Fay E. Null, Dayton, Ohio: U. S. patent 2,511,869, issued June 20, 1950.

In a pendulum apparatus, a triangular pendulum, a motor supporting said pendulum by the apex of the latter from the drive shaft of the motor, acceleration-responsive members mounted on the two lower corners of said pendulum at right angles to its axis, means for summing up the acceleration responses of said acceleration-responsive members, means for amplifying the summed up responses and means for applying the amplified responses to said motor to rotate in a direction opposite to that of the forces causing the acceleration responses. Claims allowed, 11.

MAGNETIC METHODS

12079. Magnetic flux measuring apparatus. Ernst H. Plesset, Los Angeles, Calif., assignor to the United States of America as represented by the U. S. Atomic Energy Comm.: U. S. patent 2,506,433, issued May 2, 1950.

Apparatus for measuring the magnetic flux density variation along a predetermined path which apparatus comprises a search coil, means for moving said search coil along said predetermined path transverse to the direction of the lines of force of the magnetic field, means for maintaining the axis of said search coil substantially parallel to a fixed line transverse to said path during the movement thereof, an oscilloscope having two sets of electron beam deflecting means, means for applying to one set of said deflecting means a first potential which is a function of the position of said search coil along said predetermined path, a condenser, means coupling said search coil and said condenser for developing a charge on said condenser which is a function of the variation of the density of the magnetic flux through said search coil, and means for applying to the other set of deflecting means a second potential which is a function of the charge on said condenser. Claims allowed, 5.

SEISMIC METHODS

12080. Seismic prospecting method. Cornelius G. Dahm, Dallas, Tex., assignor, by mesne assignments, to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,503,904, issued Apr. 11, 1950.

A method of obtaining seismic data where there is a sharp change in the elastic constants in the strata adjacent the earth's surface without material change in the density of the material in such strata, which comprises exploring with seismic waves said strata to determine the range of depth in which said change in elastic constants occurs, generating seismic waves below said range of depth, detecting seismic waves at points deeper in the earth than where said change in elastic constants occurs, and recording said waves in correlation with time. Claims allowed, 3.

12081. Apparatus for examination of materials by elastic waves. Marcel Meunier, Cuesmes, Belgium, assignor to Ateliers de Constructions Electriques de Charleroi, Brussels, Belgium, a Belgian societé anonyme: U. S. patent 2,505,867, issued May 2, 1950.

In the art of elastic waves, apparatus for examination of material objects by means of ultra-sonorous waves, comprising a device for emitting ultra-sonorous waves, said emitting device including a tubular support having an open end, a crystal mounted in said support near the other end thereof, said crystal being adapted to produce ultra-sonorous waves, and a sheath lining the inside of said support, said sheath being composed of a material adapted to absorb ultra-sonorus waves, said support being so arranged that a beam of ultra-sonorous waves produced by said crystal and emitted from the open end of said support will strike the surface of the object at an acute angle of incidence smaller than the angle of total reflection, said sheath absorbing any reflected waves entering the open end of said support, a device for receiving the waves of said beam passing through said object, said receiving device including another tubular support having an open end, a crystal mounted in said other support near the other end thereof, said crystal being adapted to respond to ultra-sonorous waves, and a sheath lining the inside of said other support, said sheath being composed of a material adapted to absorb ultra-sonorous waves, said other support being so arranged that a beam of ultra-sonorous waves from said emitting device passing through said object will enter the open end of said other tubular support and excite the crystal therein, said receiving device being so placed that said beam passing directly through said object will enter axially into said other support, and means for measuring the intensity of the excitation of said crystal in said receiving device. Claims allowed, 2.

12082. Vibrator type multiple-shot blasting unit. Frank C. Gibson, Broughton, Pa., and Frederick W. Brown, Los Angeles, Calif.: U. S. patent 2,506,587, issued May 9, 1950.

In combination a first switch connected between an input and a means for multiplying voltage, said first switch connecting said input to said voltage multiplying means only when said first switch is operated, a second switch connected to said voltage multiplying means, a condenser and an output, said second switch in its normal position acting to connect said condenser to said voltage multiplying means and said second switch in its operated condition acting to connect said condenser to said output. Claims allowed, 10.

12083. Seismograph compositing system. Robert W. Olson, Dallas, Tex., assignor to Geophysical Service, Inc., Dallas, Tex., a corporation of Delaware: U. S. patent 2,509,651, issued May 30, 1950.

In a multiple recording circuit that includes a plurality of circuits for supplying signals to be recorded and a plurality of recorder-operating circuits, a compositing circuit connected between at least three signal supply circuits and two recorder-operating circuits that includes two balanced bridge circuits, each of said balanced bridge circuits being comprised of one of the recorder-operating circuits and three fixed resistors connected in series across it, each resistor having a resistance equal to the resistance of the recorder-operating circuit; connections between one signal supply circuit and the diagonal corners of one of the bridge circuits; connections between another signal supply circuit and the diagonal corners of the other bridge circuit; and connections between the third signal supply circuit and the remaining pair of diagonal corners of each of the two balanced bridge circuits. Claims allowed, 2.

ELECTRICAL METHODS

12084. Electronic detector. Claude R. Daum and Louis Thomas Cleaver, Denver, Colo., assignors to the United States of America as represented by the Secretary of the Interior: U. S. patent 2,503,247, issued Apr. 11, 1950.

In combination a probe having a U-shaped magnetic core with a center portion and two legs, an input coil wound about the center portion of said core, two output coils each wound about one of the legs of said core and near the ends thereof, a compensating coil wound about the center portion of said core and in substantial axial registry with said input coil, a power supply for causing an alternating current to flow through said input coil, said alternating current causing an alternating flux to flow in said core, said output coils and said compensating coil being so connected that the voltage induced in the output coil adds each to the other while the voltage induced in said compensating coil subtracts from that produced by the output coils to produce a combined output voltage, means connecting said combined output voltage to an amplifying means, said amplifying means including electrical discharge means having at least a cathode, anode and control electrodes, means for applying an input signal to said control electrode, means whereby a negative bias is applied to said control electrode with respect to said cathode so that only the positive peaks of said input signal applied to said control grid will cause a current to flow between said cathode and anode whereby a distinctive electrical signal having harmonics is produced, means capable of transforming said distinctive electrical signal into an audible signal of similar characteristics, means for applying said distinctive electrical signal to said means for producing an audible signal. Claims allowed, 2.

RADIOACTIVE AND THERMAL METHODS

12085. Alternating current ionization chamber. Robert E. Fearon, Tulsa, Okla., assignor to Wells Surveys, Inc., Tulsa, Okla., a corporation of Delaware: U. S. patent, 2,502,617, issued Apr. 4, 1950.

A detector of ionizing radiation comprising in combination means defining a closed circulatory system, at least a portion of which is adapted to admit ionizing radiation, an ionizable medium in said system, means for circulating said medium in the system to expose it to the admitted radioactive ionizing emanations, said means being adapted to impart surges to said ionizable medium that are separated by uniform time intervals, means for de-ionizing said medium before it enters the portion adapted to admit ionizing radiation, means for separating the ions produced by said radiation when the medium enters that portion, means for collecting one group of the separated ions, and means for measuring the alternating component of the electrical current produced by the collection of said ions as a measure of radiation. Claims allowed, 9.

12086. Method and apparatus of measuring the activity of radioactive materials. Gregory H. Wannier, Pitman, N. J., assignor to Socony-Vacuum Oil Co., Inc., a corporation of New York: U. S. patent 2,502,683, issued Apr. 4, 1950.

An apparatus for measuring the activity of a sample of radioactive material that comprises a counter tube, means defining a window in the counter tube, means transparent to radiation emitted by the sample for sealing said window, a sample holder disposed adjacent said window, said sample holder having a concave recess in the side thereof adjacent to and in axial alignment with said window, a coating of the radioactive material on the surface defining the concave recess, the curvature of the recess bearing a relation to the axial distance between the sample and the window such that the solid angle subtended by the window at any point on the concave surface of the sample is a constant. Claims allowed, 3.

12087. Geiger counter and gas atmosphere therefor. Lloyd G. Shore, Chicago, Ill., assignor to Radiation Counter Laboratories, Inc., Chicago, Ill., a corporation of Illinois: U. S. patent 2,503,302, issued Apr. 11, 1950.

A self-quenching Geiger counter containing oxygen, nitrogen, xenon, and argon in such proportions that their partial pressures in millimeters of mercury are as follows when the total gas pressure is about 740 mm. of mercury:

O_2—trace to 30
N_2—trace to 30
Xe—at least ½
A—balance

Claims allowed, 3.

12088. Method and apparatus for detecting ionizing particles. Elizabeth R. Graves, Santa Fe, N. Mex., assignor to the United States of America as represented by the U. S. Atomic Energy Comm.: U. S. patent 2,506,419, issued May 2, 1950.

A device of the character described having in subcombination, an electrode assembly comprising three inherently rigid generally planiform elements in mutual parallel spaced relation to provide a pair of outer electrodes and an electrode disposed centrally therefor, said centrally disposed electrode being provided with an area of reduced thickness to permit passage of ionizing particles therethrough while providing an effective ion shield, one of said outer electrodes being provided with a collimated portion of sufficiently smaller area than the reduced thickness area of said centrally disposed electrode to confine particles emitted therethrough to said reduced thickness area, the inner surface of said collimator area being provided with a thin sheet of material adapted to pass ionizing particles while providing an ion shield, and means associating with said collimated electrode for the mounting of an ionizing particle emitter contiguous to the outer surface thereof. Claims allowed, 3.

12089. Amplifying and quenching circuits for radiation detectors. Donald G. C. Hare, Roslyn, N. Y., assignor to Texaco Development Corp., New York, N. Y., a corporation of Delaware: U. S. patent 2,503,730, issued Apr. 11, 1950.

In combination, a radiation detector of the counter type, an electronic discharge tube having its plate connected to the anode of the detector, means for impressing a high direct current voltage for the operation of the detector on the anode of the detector and the plate of said tube, a second electronic discharge tube, said first and second tubes being interconnected in multivibrator relationship, means to impress an operating direct current voltage on the plate of the second tube, said operating voltage being independent of that impressed on the anode of the detector and the plate of the first tube, whereby, on discharging the detector, a negative pulse is supplied to the control grid of the second tube and a positive pulse from the plate of the latter to the control grid of the first tube through the multivibrator connections to cause said first tube to pass current and lower the potential on the detector anode, causing the detector to quench, and means to take a pulse from an electrode of one of said tubes. Claims allowed, 3.

12090. Radiation measurement. Bruno B. Rossi, Winchester, Mass., and James S. Allen, Champaign, Ill., assignors to the United States of America as represented by the U. S. Atomic Energy Comm.: U. S. patent 2,506,435, issued May 2, 1950.

In radiation measurement apparatus, in combination: a radiation counter having an anode, a cathode and an ionizing medium between said electrodes; and a source of direct voltage having superimposed thereon voltage pulses of alternately positive and negative phase coupled to said electrodes, the voltage pulses having an amplitude sufficient to alternately impress on said electrodes a voltage above the sparking potential and a voltage below the extinction potential thereof. Claims allowed, 3.

12091. Neutron meter. Lynn H. Stauffer, Rotterdam Junction, and Thoma M. Snyder, Schenectady, N. Y., assignors, by mesne assignments, to the United States of America as represented by the U. S. Atomic Energy Comm.: U. S. patent 2,506,944, issued May 9, 1950.

A neutron meter comprising a plurality of spaced regions containing a gaseous boron compound, at least one intermediate region formed of a non-gaseous hydrogen containing compound, and means for measuring the ionization of said gaseous boron compound. Claims allowed, 7.

12092. Method of geophysical prospecting. Bruno Pontecorvo, Montreal, Quebec, Canada, assignor to Well Surveys, Inc., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,508,772, issued May 23, 1950.

A method of geophysical prospecting that comprises irradiating formations surrounding a drill hole about which information is desired with radioactive radiation, measuring radiation that returns from said formation, at a series of spaced points that differ in their distances from the source of radiation by regularly spaced intervals, sequentially selecting signals indicative of measurements made at the different points, and graphically representing said sequentially selected signals in correlation with the distances between source and detectors for selected depths of the source in the drill hole to form a continuous curve graphically representative of the decay in intensity of the returning radiation as the distance from the primary source of radiation increases. Claims allowed, 2.

12093. Alpha ray source and method of producing same. Marietta Blau and Boris Pregel, New York, N. Y., assignors to Canadian Radium & Uranium Corp., New York, N. Y., a corporation of New York: U. S. patent 2,510,795, issued June 6, 1950.

The method of producing an alpha ray source which includes, depositing radium emanation in a solid state in a finely divided solid supporting material and maintaining said emanation in a solid state until decay thereof to radium D and polonium has taken place for most of the said emanation. Claims allowed, 9.

12094. Radiographic scanning unit. Herman F. Kaiser, Washington, D. C.: U. S. patent 2,511,853, issued June 20, 1950.

A radiographic device for examining a test object comprising a source of radiation, means forming the incident radiation into a relatively thin collimated planar beam, means supporting the test object, means for sweeping the beam of incident radiation across the test object in a direction normal to the plane of the beam to irradiate a single line portion of the test object at a time, and means sensitive to the emergent radiation for detecting said radiation. Claims allowed, 5.

12095. Device for comparing with a common physical receiving means, two radiations of similar character and subsidiarily recording the ratio between said radiations. Etienne Vassy, Paris, France: U. S. patent 2,512,122, issued June 20, 1950.

In a device of the type described, in combination, a single receiver adapted to be struck by a pair of separate beams of radiations to be compared, a rotary obturating means adapted when rotated to cut off each of said beams from said single receiver in alternating sequence, a single path electronic amplifier including an output electronic tube, said amplifier being fed from said receiver, a pair of triode electronic tubes having the grid circuits thereof supplied in parallel by the anode circuit of said output tube, means synchronized with said rotary member for alternately biasing said triodes to cut-off in synchronism with the cutting off of said beams, a high voltage source supplying said triodes, a pair of load resistances and a potentiometric gain-balancing means inserted between said high voltage source and the anodes of said triodes, a pair of diode tubes across each of said load resistances respectively, each having its cathode connected to the anode of the respective one of said triode, a pair of condensers having a first electrode thereof connected to the anode of a corresponding one of said diode and the other electrode thereof grounded, an indicating device connected to said first condenser electrodes, and resistance-capacitance filter means inserted between said first condenser electrodes and said indicating device, whereby a voltage drop appears between the terminals of said indicating device whenever the amplified pulses from said electronic amplifier differ in amplitude due to a difference in the respective amplitudes of both said beams of radiations. Claims allowed, 4.

12096. Neutron detection. Kenneth C. Crumrine, Bellaire, Tex., assignor to The Texas Co., New York, N. Y., a corporation of Delaware: U. S. patent 2,512,769, issued June 27, 1950.

In a neutron detector, a housing, a wire anode, a cathode and a gas in said housing, said cathode comprising a sheetlike metal member having a coating on at least part of its surface of a substance capable, when bombarded by neutrons, of ejecting alpha particles to ionize said gas, said coating being composed of minute particles of said substance in an adhesive binder and having a surface area several times the area of the coated portion of said member, said particles averaging 1 mil in grain size. Claims allowed, 5.

12097. Radioactive measuring. Gerhard Herzog and Allen D. Garrison, Houston, Tex., assignors to Texaco Development Corp., New York, N. Y., a corporation of Delaware: U. S. patent 2,512,773, issued June 27, 1950.

A radiation detecting device comprising a sealed casing, a cathode member and an anode member within the casing and adapted to be connected to a source of high potential, and a gaseous filling within the casing, said filling consisting of a rare gas selected from the group consisting of argon, neon and krypton containing from 0.1 percent to 10 percent of anhydrous ammonia. Claims allowed, 6.

12098. Temperature responsive measuring apparatus. Edgar M. Smith, Trenton, N. J., assignor, by mesne assignments, to Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., a corporation of Delaware: U. S. patent 2,509,046, issued May 23, 1950.

A potentiometric measuring circuit for measuring the voltages of two thermocouples differing so that similar variations in their cold junction temperatures produce a greater difference in the voltage of one thermocouple than in the voltage of the second thermocouple, with scale suppression and cold junction temperature compensation differences between the measurements, said circuit including a slide-wire resistance, a resistor having a resistance which varies with its temperature, and resistance material in series with said resistor and varying in resistance with its temperature, a source of current and an adjustable resistance included in said circuit and creating regulable current flows through said slide-wire resistance and through said resistor and resistance material, a contact adjustable along said slide-wire resistance, a current responsive device, two thermocouples and means for connecting said thermocouples one at a time in said circuit in series with said device between said contact and said resistance material, said one thermocouple being connectable to said resistance material at the end of the latter remote from said resistor, so that the voltage of said one thermocouple and said current source tend to produce current flows in opposite directions through said resistance material and resistor, and said second thermocouple being connectable to said resistance material at the end of the latter adjacent said resistor so that said second thermocouple and said current source tend to produce current flows in opposite directions through said resistor, the variations in resistance of said resistor and resistance material due to ambient temperature changes being so related to the changes in the voltages of said thermocouples produced by their respective cold junction temperature changes resulting from said ambient temperature changes as to compensate for variations in the cold junction temperature of each thermocouple when that thermocouple is connected in said measuring circuit. Claims allowed, 3.

12099. Temperature responsive measuring apparatus. Charles A. Vogelsang, Erdenheim, Pa., assignor, by mesne assignments, to Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., a corporation of Delaware: U. S. patent 2,509,048, issued May 23, 1950.

A potentiometer measuring circuit for measuring the voltages of two thermocouples differing in their cold junction temperature compensation requirements with a scale suppression difference between the measurements, said circuit including a slide-wire resistance and a resistance section including in series a resistor having a resistance which varies with its temperature, resistance material varying in resistance with its temperature, and a resistance element, the resistance of which does not vary with its temperature and which is large in comparison with the sum of the resistance of said resistor and resistance material, means comprising a source of current and an adjustable resistance included in said circuit for creating and regulating current flow through said slide-wire resistance and resistance section, a contact adjustable along said slide-wire resistance, a current responsive device, and means for connecting said thermocouples one at a time in series with said device between said contact and said resistance section, one of said thermocouples being connectable to said section at one end, and the other of said thermocouples being connectable to said section at the other end of said resistance material, the variations in resistance of said resistor and resistance material due to ambient temperature changes being so related to the changes in the voltages of said thermocouples produced by their respective cold junction changes resulting from said ambient temperature changes as to compensate for variations in the cold junction temperature of each thermocouple when that thermocouple is connected in said measuring circuit and circuit calibrating means comprising a standard cell and switch means for operatively connecting said device and said cell in series with one another between the terminals of said resistance element. Claims allowed, 3.

WELL LOGGING

12100. **Radioactive borehole logging.** Arnold J. F. Siegert, Syracuse, N. Y., and Bob E. Watt, Houston, Tex., assignors to Texaco Development Corp., New York, N. Y., a corporation of Delaware: U. S. patent 2,504,888, issued Apr. 18, 1950.

The method of logging a borehole traversing subsurface formations which comprises passing through said hole a source of gamma rays capable of penetrating said formations to induce neutrons therefrom, and measuring variations in the intensity of the induced neutrons reaching the hole from said formations as the source and neutron detector are moved through the hole. Claims allowed, 9.

12101. **Well logging.** Gerhard Herzog, Houston, Tex., assignor to Texaco Development Corp., New York, N. Y., a corporation of Delaware: U. S. patent 2,506,149, issued May 2, 1950.

In logging involving the detection of variations in radiation along a borehole, the improvement which comprises passing a chain of spaced radiation detectors along the borehole so that the responses of the individual detectors to radiation from the same level in the borehole are displaced in time and automatically combining the individual responses from that level by automatically accumulating in the neighborhood of the surface of the ground the responses as a series of condenser charges. Claims allowed, 16.

12102. **Transmitting of information in drill holes.** Serge A. Scherbatskoy, Tulsa, Okla., assignor to Well Surveys, Inc., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,507,351, issued May 9, 1950.

An apparatus for transmitting data from a well surveying subsurface instrument to a recording system located on the surface of the earth which comprises means for producing electrical signals varying in sympathy with the variation of a physical property of the strata traversed by the well, means for simultaneously producing a succession of ultra high frequency electromagnetic impulses of equal duration, said means including an electronic timer adapted to produce electrical impulses of equal duration and at varying intervals of time, means for connecting said electronic timer to the means which produces electrical signals varying in sympathy with the variation of a physical property of the strata traversed by the well, an oscillator, a modulator, means for connecting the output of said modulator to said oscillator, means for connecting the output of said electronic timer to said modulator, and means for connecting the output of said oscillator to a directional antenna whereby the ultra high frequency electromagnetic impulses controlled by said electronic timer and produced by the oscillator will be directionally radiated up the drill hole from the subsurface instrument. Claims allowed, 1.

12103. Time-locking instrument for surveying inclination and direction of boreholes. Charles Trotter and Yrjo Pajari, Sudbury, Ontario, Canada: U. S. patent 2,508,899, issued May 23, 1950.

In a surveying instrument of the type described having an outer frame, an inner frame pendulously suspended from the outer frame, and a case pendulously suspended from the inner frame, a time-piece movement encased within the case, a driving gear, an axle within the driving gear, a plurality of flexible fins extending radially from the said axle, the said axle being operable frictionally to transmit torque to the driving gear in one direction and slidably rotate within the driving gear in the opposite direction, a protrusile pin carried by the case, a protractor locking lever attached to the axle, said lever being shaped and located for co-action with a protrusile pin, a protractor having grooves on its inner periphery to receive the said protrusile pin, means to eject the said protrusile pin whereby the spherical case is locked in its pendulously static position within the protractor, said protractor being integral with the inner frame, means to retract the said protrusile pin to allow free pendulous action of the spherical case within the protractor. Claims allowed, 9.

12104. Gun perforator. James O. Tow, Huntington Park, Calif., assignor to McCullough Tool Co., Los Angeles, Calif., a corporation of Nevada: U. S. patent 2,509,657, issued May 30, 1950.

In a gun mechanism for perforating well casing, the combination of: a gun body having a propellant chamber with a propellant charge therein, a gun barrel, and a projectile therein, with walls forming an ignition passage leading from the interior of the barrel ahead of said projectile into said propellant chamber and means for limiting the rearward movement of said projectile; a firing charge in the gun barrel ahead of the projectile; and means for exploding said firing charge whereby combustion products therefrom will travel through said ignition passage and ignite said propellant charge. Claims allowed, 10.

12105. Coring and fluid sampling device. Ferdinand W. Rolshausen and Saint E. Swain, Houston, Tex., assignors to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,509,883, issued May 30, 1950.

An improved sample taking device adapted for movement along a drill stem and for simultaneously taking a side wall fluid sample and a side wall core sample through a core bit attached to a drill stem comprising, in combination, an elongated cylindrical body defining a fluid sample chamber in the lower end thereof, releasable latching means arranged at the upper end of said body to latch it to said drill stem, a tubular shaped core barrel provided with notches in its upper end and having a longitudinal fluid passage in its walls extending from the lower end into the upper end thereof, means journalling the upper end of said core barrel to the lower end of said body, said journalling means having fluid passages therein adapted to establish fluid communication between said sample chamber and the fluid passages in said core barrel when the latter is in a core sampling position and to prevent said communication when the core barrel is moved along the drill stem, a spring arranged to bias the free end of said core barrel away from the longitudinal axis of said body, and releasable means arranged for latching said barrel with its longitudinal axis parallel with the longitudinal axis of said body including an annulus slidingly arranged on said body and downwardly extending members secured to said annulus arranged to engage said notches on the core barrel. Claims allowed, 1.

12106. Radiological well logging. Kenneth C. Crumrine, Bellaire, Tex., assignor to The Texas Co., New York, N. Y., a corporation of Delaware: U. S. patent 2,509,908, issued May 30, 1950.

A device for logging a borehole comprising a housing adapted to be lowered and raised through said hole, a source of neutrons and a detector of neutrons in said housing, said detector being responsive to neutrons from said source scattered in said formations and returned to said hole, a sleeve immediately surrounding and continuously movable with said housing and adapted to occupy most of the annular space between said housing and the wall of the hole, said sleeve being formed of a material such as aluminum substantially transparent to said neutrons, and means for recording the output of said detector. Claims allowed, 5.

12107. Rock coring method. William S. Walls, Bartlesville, Okla., assignor to Phillips Petroleum Co., a corporation of Delaware: U. S. patent 2,510,300, issued June 6, 1950.

In cable tool coring operations employing a drilling fluid having an oil base the method of reducing the free water content of the drill cuttings present in the bore comprising the step of adding a quantity of at least one of the water absorbing clays from the group consisting of bentonite and bauxite in the form of small pieces to the drilling fluid in the bore, said water absorbing material being in particle sizes sufficiently large to enable it to pass through the oil phase and reach the bottom of the bore and in sufficient quantity to prevent the formation or maintenance of a mud phase in the bore. Claims allowed, 5.

12108. Side wall coring tool. Charles O. Denning and John R. Yancey, Houston, Tex., assignors to A–1 Bit & Tool Co., Inc., Houston, Tex., a corporation of Texas: U. S. patent 2,510,386, issued June 6, 1950.

A core taking device for wells comprising; a whip stock including a shell having a side opening and a deflector in the shell; an operating string having a rotatable connection with the whip stock; a core taker including a barrel and a driving stem adapted to be lowered through the operating string into co-acting relation with the deflector to deflect the barrel through the opening, said driving stem having an inlet opening in communication with said operating string and a side outlet opening; a tubular valve in the stem; frangible means normally holding said valve in position to close said side outlet opening; a tubular screen connected to the valve and extending up into the driving stem; a driving connection between the string and stem whereby the stem and barrel may be rotated. Claims allowed, 6.

12109. Side wall sample taken. Maurice P. Lebourg, Houston, Tex., assignor to Schlumberger Well Surveying Corp., Houston, Tex., a corporation of Delaware: U. S. patent 2,511,408, issued June 13, 1950.

A device for taking samples of the formations traversed by a borehole comprising a gun body having an aperture extending completely transversely therethrough adapted to be lowered into a borehole, a hollow sample-taking projectile in said aperture and of substantially the same length as said aperture, and cooperating means on said gun body and on said projectile forming a chamber between the ends of said aperture for receiving an explosive charge and providing an acting surface on the projectile for said explosive charge for propelling said projectile from said aperture. Claims allowed, 10.

12110. Radiological well logging. Gerhard Herzog, Houston, Tex., assignor to The Texas Co., New York, N. Y., a corporation of Delaware; U. S. patent 2,512,020, issued June 20, 1950.

A method of logging a borehole which comprises passing through said hole a source of neutrons whereby neutrons in penetrating the walls of the hole liberate gamma rays, and simultaneously measuring the intensity of said liberated gamma rays which pass from the hole walls into the hole to zones spaced equidistantly from and at opposite sides of said source. Claims allowed, 10.

12111. Well survey method and apparatus. Robert Earl Fearon, Tulsa, Okla., assignor to Well Surveys Inc., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,513,086, issued June 27, 1950.

In a device for geophysical exploration which includes a measuring instrument adapted to be lowered into a drill hole to measure phenomena indicative of the character of the surrounding strata and a recorder on the surface for recording said measurements, the improvement that comprises, as means to connect the measuring instrument and the recorder, a means at the measuring instrument to generate oscillations, means to modulate the amplitude of said oscillations in accordance with the magnitude of the measurement being made, means to generate oscillations of a frequency different from the first mentioned oscillations and of a constant amplitude, means to impress both of said oscillations upon the surrounding earth at the measuring instrument, means at the surface of the earth to detect both of said oscillations, means to divide the amplitude of one of said detected oscillations by the amplitude of the other and means to operate a recorder in accordance with the quotient so obtained. Claims allowed, 5.

TECHNICAL AIDS

12112. Correcting pendulum grade-angle measurements. Daniel Silverman, Joseph D. Eisler, and Julian F. Evans, Tulsa, Okla., assignors to Stanolind Oil and Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,503,422, issued Apr. 11, 1950.

In surveying apparatus, including, in combination, a gravity-responsive pendulum, a support for said pendulum adapted for transportation along a traverse and for orientation according to the grade angles encountered, torsion means suspending said pendulum from said support and exerting on said pendulum a torque such that the pendulum angle relative to said support is less than the corresponding grade angle, a rotatable follower arm pivoted in said support concentrically with but independent of said pendulum, an integrator adjusting member displaceable linearly perpendicular to the following arm direction for zero grade angle, and means controlled according to said pendulum angle for actuating said member and rotating said follower arm through twice said pendulum angle, the improvement comprising a variable coupling between said member and said follower arm, which coupling comprises a lever pivoting about a point spaced from the axis of rotation of said pendulum, said lever being coupled to said displaceable member and slidably coupled to said follower arm, the spacing of said pivoting point being so related to the length of said follower arm as to make the displacements of said member proportional to the sine of the grade angle throughout a substantial range. Claims allowed, 5.

12113. Pendulum system for grade-angle measurements. Daniel Silverman, Joseph D. Eisler, and Julian F. Evans, Tulsa, Okla., assignors to Stanolind Oil and Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,503,423, issued Apr. 11, 1950.

In an elevation meter of the type described, apparatus for producing a displacement proportional to the sine of a grade angle comprising, in combination, a gravity-responsive pendulum, a support for said pendulum adapted for transportation along a traverse and for orientation according to the grade angle encountered, a pair of torsion fibers suspending said pendulum from said support and exerting on said pendulum a torque such that the pendulum angle relative to said support is less than the corresponding grade angle, a rotatable follower arm pivoted concentrically with but independent of said pendulum, an integrator-adjusting member displaceable linearly perpendicular to the follower arm direction for zero grade angle, said member being coupled to said arm by a coupling adapted to make the displacement of said member proportional to the sine of the corresponding arm angle, and means for actuating said follower arm and said member including: a mirror on the pendulum axis, a light source unit and a photocell unit cooperating with said mirror, one of said units being fixed and the other mounted on said arm, whereby, in maintaining light from said source reflected by said mirror onto said photocell unit, said arm rotates through twice the mirror angle; said mirror being spaced away from said pendulum at a position along the length of one said fibers where the angle of rotation of said fiber is substantially one-half the corresponding grade angle. Claims allowed, 2.

12114. Apparatus for calibrating vibration equipment. Welcome W. Bender, Jr., Baltimore, William B. Bergen, Glenarm, and William G. Purdy, Baltimore, Md., assignors to the Glenn L. Martin Co., Middle River, Md., a corporation of Maryland: U. S. patent 2,505,601, issued Apr. 25, 1950.

A calibrating device capable of producing motion of sinusoidal form of variable amplitude including a housing, a vibrating table, and table vibrating means, comprising a slotted disc having a rack attached thereto, and positioned to rotate within a Scotch yoke having horizontal and vertical guide members, supporting members positioned to support the vibrating table on the top member of said Scotch yoke, an outer shaft journalled to be rotated by energy transmitted through an attached flywheel, said shaft being adapted to rotate said disc, an inner shaft mounted to rotate angularly within said shaft, a pulley having a slotted flange attached to said inner shaft adjacent said flywheel and secured thereto by adjustable securing means for positioning the flange relative to the flywheel and a gear secured to the inner shaft positioned to engage said rack to afford external adjustment of the eccentricity of the slotted disc relative to said Scotch yoke. Claims allowed, 6.

12115. Pendulum inclinometer. Ronald L. R. Cockerell, Regina, Saskatchewan, Canada: U. S. patent 2,505,884, issued May 2, 1950.

An inclinometer comprising a base having a pair of fixed parallel arms rising therefrom, a cylindrical casing positioned between said arms and formed with a viewing opening in its peripheral wall, axial bearing means on said casing having outer portions supportably engaging the related arms and maintaining said casing in fixed relation to said arms and said base, said axial bearing means having inner portions projecting into said casing from opposite sides thereof, a pendulum axle positioned between and having its ends journalled in said inner portions, a disk fixed on said axle intermediate its ends and in spaced relation to the opposite sides of said casing, a cylindrical calibrated rim fixed on the periphery of said disk with its side edges positioned close to the sides of the casing and with its calibrations visible through said viewing opening, and a pendulum weight fixed to said disk. Claims allowed, 3.

12116. Pulse-reflection distance-measuring system. Henry O. Wright, Suffern, N. Y., assignor to Bell Telephone Laboratories, Inc., New York, N. Y., a corporation of New York: U. S. patent 2,507,746, issued May 16, 1950.

A radio distance-measuring system comprising a transmitter of substantially constant pure carrier frequency radio-wave energy, means for actuating said transmitter to emit short pulses of radio-wave energy at regularly recurrent time intervals, said intervals being at least of sufficient length to permit a transmitted pulse to travel to a reflecting surface at the maximum distance to be measured and to return by reflection to the system before the next successive pulse is emitted, means separate from and having no effect upon the output of said transmitter, for producing electrical wave energy of a heterodyne frequency continuously varying over a predetermined range of frequencies during each said time interval, means for receiving reflections of said transmitted pulses from a surface the distance of which is to be measured, means for combining said received reflected pulses and said heterodyne frequency energy and detecting the beat-note frequencies therebetween, means for determining the frequencies of said beat-notes to obtain an indication of the distance of said reflecting surface. Claims allowed, 6.

12117. Transducer for ultrasonic waves. Howard H. Claassen, Norman, Okla., assignor to Phillips Petroleum Co., a corporation of Delaware: U. S. patent 2,507,770, issued May 16, 1950.

In combination, a member adapted to vibrate at ultrasonic frequencies, said member having a resonant frequency, a body of conductive liquid in intimate contact with one face of said member, an electrode in contact with another face of said member, and another electrode spaced from said member and engaging said liquid body. Claims allowed, 5.

12118. Underwater meter-leveling device. Arnold H. Goetsch, Houston, Tex., assignor, by mesne assignments, to La Coste and Romberg, Austin, Tex., a partnership: U. S. patent 2,507,900, issued May 16, 1950.

In a device of the class described, a support, a base, means for resiliently urging the support to spaced relation from the base, and additional means for adjustably applying tension between the support and base at a plurality of points to vary the angular relation therebetween and level the support. Claims allowed, 5.

12119. **Radio object position indicator using colors for distance indication. Waldemar A. Ayres, Kew Gardens Hills, N. Y., assignor to The Sperry Corp., a corporation of Delaware: U. S. patent 2,508,358, issued May 23, 1950.**

Object locating apparatus comprising a source of electromagnetic energy, scanning means including a directional antenna connected to said energy source for successively irradiating objects disposed in space, a receiver connected to receive electromagnetic energy reflected from said objects, circuit means controlled from said receiver and responsive differently to received reflected energy depending on the ranges of the objects from said apparatus, means including a cathode ray tube controllable in synchronism with said scanning means and connected to said circuit means for providing indications of the positions of the objects, and chromatic means controllable in synchronism with said circuit means and cooperable with said cathode ray tube for rendering said position indications of said objects colored in accordance with the respective ranges of the objects. Claims allowed, 25.

12120. Method and means for automatic tracking and/or ranging. Milton H. Gross, Berkeley, Calif., assignor to the United States of America as represented by the Secretary of War: U. S. patent 2,508,384, issued May 23, 1950.

In a radio detection system transmitting successive pulses of energy and receiving echoes from a target, the delay of said echoes with respect to said pulses being proportional to the range of said target, and transforming said echoes into deflections of an electron beam having a sweep synchronized with said pulses, those steps in the method of automatically following changes in the range of said target which include, adjusting the phase of said sweep relative to said pulses until the delay of the initial deflections relative to said pulses corresponds to the initial range of said target, generating an electrical quantity proportional in amount and polarity to the deviation from said initial range, and altering the phase of said sweep with respect to said pulses by means of said electrical quantity to compensate for said deviation. Claims allowed, 10.

12121. Frequency-modulated direction- and range-finding apparatus. Martin V. Kiebert, Jr., Arlington, Va.: U. S. patent 2,508,400, issued May 23, 1950.

In an echo-ranging system having a transmitter station for detecting the presence of at least one target at a distance from the station, in combination, a master control oscillator, additional oscillator means operatively connected to and controlled by said master oscillator for producing a control signal varying linearly with time, means for generating high frequency oscillations, means connected to said generating means and said additional oscillator means for utilizing said control signal for frequency modulating said high frequency oscillations, rotatable antenna means including transmitting and receiving reflectors, means for rotating said antenna means, said means for generating high frequency oscillations being operatively connected to said transmitting reflector for energizing the same and transmitting a beam wave of frequency modulated radiant energy, a mixing circuit operatively connected to said means for generating high frequency oscillations and to said receiving reflector for producing at least one signal of a beat frequency substantially proportional to the time of propagation of said wave over twice said distance, a mixer operatively connected to said mixing circuit and energized by the beat frequency signal, a cathode ray tube having an intensifier grid, a search oscillator connected to said mixer and to said additional oscillator means, said search oscillator being constructed and arranged to periodically generate an additional signal covering a predetermined range of frequencies at a period controlled by said additional oscillator means, said mixer supplying an output signal of a frequency which is the algebraic sum of the frequencies of the beat frequency signal and additional signal applied thereto from the mixing circuit and the search oscillator respectively, a filter interconnecting said mixer and said intensifier grid for passing said output signal to said grid only when said output signal has a predetermined frequency, blanker means operatively connected to said intensifier grid and to said additional oscillator means and controlled by the latter, sweep generator means for said cathode ray tube operatively connected to and controlled by said additional oscillator means, and means operatively connected to said rotating means for rotating the sweep of said cathode ray tube in synchronization with said antenna means thereby to provide a sweep having an instant setting corresponding to the instant setting of said rotatable antenna means. Claims allowed, 8.

12122. Differential altimeter. William Shockley, Madison, N. J., assignor to Bell Telephone Laboratories, Inc., New York, N. Y., a corporation of New York: U. S. patent 2,509,889, issued May 30, 1950.

An altimeter comprising a vessel and a conduit immediately attached thereto, said conduit providing inlet and outlet means for said vessel and having a uniform inside dimension throughout its length, two thermally sensitive resistors each having the characteristic of rapidly varying in resistivity with change of temperature axially mounted in said conduit, means in said conduit forming oppositely disposed nozzles between said resistors, each of said nozzles being adjacent and directed toward an individual resistor, a heating coil axially mounted in said conduit between said nozzles, said resistors being connected in a Wheatstone bridge circuit, current supply means for said bridge, and means connected to said bridge circuit to indicate the difference in temperature of said resistors as determined by the flow of heat from said heating coil through one of said nozzles to the resistor adjacent thereto or through the other of said nozzles to the resistor adjacent thereto in response to the flow of air into and out of said vessel due to changes in pressure. Claims allowed, 1.

12123. Dynamic galvanometer. Edward W. Kellogg, Indianapolis, Ind., assignor to Radio Corp. of America, a corporation of Delaware: U. S. patent 2,510,585, issued June 6, 1950.

A galvanometer comprising means for obtaining a magnetic field, an armature support positioned in said field, an actuating coil wound on said support, means for flexibly mounting said armature support for rotation at a plurality of bearing points, said mounting preventing lateral displacement of said armature, a mirror mounted on said armature support externally of said magnetic field, and a line damper mounted on the end of said armature support. Claims allowed, 15.

12124. Time interval measuring device. Earl G. Newsom, Dayton, Ohio: U. S. patent 2,511,868, issued June 20, 1950.

A radio circuit for measuring short time intervals, comprising a power supply, a voltage divider connected across said power supply, a load circuit connected across said voltage divider, a fixed resistor in said load circuit, a rheostat in series with said fixed resistor in said load circuit and having a scale, an adjustable arm for varying the resistance introduced by said rheostat in said load circuit, a switch having a movable switch arm adapted for sweeping across a plurality of switch contacts, a first capacitor connected between said switch arm and ground, a ground contact engageable by said switch arm for grounding both plates of said capacitor and effecting substantially the complete discharge thereof, a second contact engageable by said switch arm, a variable resistor connected to said second contact, a tap adapted for being adjustably positioned along said voltage divider and connected to said second switch contact through said variable resistor, a second capacitor connected between the junction of said variable resistor with said tap and ground, a third switch contact engageable by said switch arm, and a balancing meter connecting said third switch contact with the junction of said fixed resistor with said rheostat in the load circuit of said voltage divider for indicating a potential balance between said first capacitor and said rheostat upon the adjustment of said rheostat arm upon said rheostat so that the rheostat scale reading is a measurement of the time interval during which said first capacitor is charged. Claims allowed, 11.

12125. Vibrating table. Cyril Maurice Grahame Calver, Bushey, England: U. S. patent 2,512,304, issued June 20, 1950.

A vibration test machine comprising in combination a vibratory table, a carriage for the table permitting movement of the latter in two planes angularly displaced, at least two rotary shafts, each having an eccentric coupling to the table, with the two shafts disposed with their axes angularly displaced with respect to one another at the required angle, and means to adjust the eccentricity of the coupling between each shaft and the table. Claims allowed, 11.

INDEX

Abstract
Agamennone, Giovanni 11956, 11957
Ageno, Mario 11970
Agocs, W. B 12037
Allen, J. S 12090
Almeida, Rolff, P. A. M. de 12063
Altenburg, K 11945
Al'thausen, O. N 11937
Anderson, H. H 12020
Archie, G. E 11991
Arnett, R. A 12018
Ayres, W. A 12119

Baars, B 11909
Ballarin, S 12011
Bates, Charles 12077
Beck, A. F 11999
Bemrose, John 12013
Bender, Welcome W 12114
Bergen, W. B 12114
Blau, Marietta 12093
Branham, C. A 12010
Brown, F. W 12082
Browne, B. C 11927
Brownell, G. M 12067
Buell, M. W., Jr 11980
Bullard, E. C 11935, 11986
Bullen, K. E 11981, 11982, 11983

Caloi, Pietro 11954
Calver, C. M. G 12125
Campbell, O. E 12074
Cantos Figuerola, José 12008
Casertano, Lorenzo 11972
Cassinis, R 12012
Chang, T. H 12057
Chao, Jen-Shou 11934
Chen, P. C 11941
Chiozzotto, Mario 11970
Claassen, H. H 12117
Cleaver, L. T 12084
Clewell, D. R 12025
Coates, J 12000
Cockerell, R. L. R 12115
Cole, J. H 11908
Cook, A. H 11926
Cook, K. L 12015
Cooper, R. I. B 11912, 11927
Coron, Suzanne 11928
Crumrine, K. C 12096, 12106
Cunietti, Mariano 11931

Dahm, C. G 12080
Damon, P. E 11971
Daum, C. R 12084
Denning, C. O 12108
Di Filippo, Domenico 11955
Due Rojo, Antonio 11947

Abstract
Eisler, J. D 12112, 12113
Elsasser, W. M 11987, 11988
Enenstein, B. S 12044
Epinat'eva, A. M 12030
Ermert, E. A 12017
Evans, J. F 12112, 12113
Evans, P 12000
Ewing, Maurice 11951, 11952, 11953

Fearon, R. E 12085, 12111
Festa, G 11966
Finley, J. C 12001
Fries, Carl, Jr 11975

Garcia Rojas, Antonio 12006
Garrison, A. D 12097
Geoffroy, P. R 11994
Gibson, F. C 12082
Glaessner, M. F 11979
Glenn, A. H 12077
Goetsch, A. H 12118
Goguel, Jean 11978, 12059
Graves, E. R 12088
Green, C. H 12019
Gross, M. H 12120
Guerra Peña, Felipe 12076
Gutiérrez, Celedonio 11975

Hallenbach, Franz 11921
Hare, D. G. C 12089
Hatsuda, Zin'ichiro 12060
Hattori, Yasumasa 12024
Hazebroek, P 12039
Heggblom, J. C 12013
Heinrich, R. R 11961
Heiskanen, W 11922
Heroy, W. R 12018
Hess, H. H 11980
Herzog, Gerhard 12097, 12101, 12110
Hirvonen, R. A 11919
Holt, T. C 12013
Hysom, R. L 11993

Iida, Kumizi 12029
Ikegami, Ryohei 11963
Imamura, Akitsune 11958
Inagaki, H 12053
Informaciones y Memorias de las Sociedad de Ingenieros del Peru 12004
Inglada Ors, Vicente 11942
Ingram, R. E 11948
Innes, M. J. S 12009
Ito, Junji 12043
Ives, R. L 11969

Jaroszewicz-Halicka, Antonina 12005
Jeffreys, Harold 11918, 11989
Jemma, Raimundo 12042

Abstract
Kaiser, H. F. 12094
Kato, Motohiko 12007
Kellogg, E. W 12123
Kelly, S. F 11995, 11998
Kemp, C. E 12062
Kiebert, M. V., Jr 12121
Kishinouye, Fuyuhiko 11968
Kisslinger, Carl 11949
Kiyono, Takeshi 12043, 12051, 12053
Kolmogorov, A. N 12068
Koulomzine, T 11994
Krey, Theodore 12031
Krouskij, L 12032
Kunz, Bruno 11992
Kurata, Nobuo 12054

Lagerquist, P. A 11910
Lagrula, Jean 11932
Lebourg, M. P 12109
Lesage, M 12066
Lozano Calvo, Luis 11929, 11930, 11990
Lundberg, Hans 11996
Lutz, W 12064, 12065
Lynn, R. D 12033

Macelwane, J. B 12002
McGaha, S. W 12073
McGee, D. A 12001
Magnitskii, V. A 11923
Makino, Naofumi 12052
Marcelli, L 11954
Martner, S. T 11950
Melchiori, G 12016
Meunier, Marcel 12081
Milne, W. P 12071
Mironov, A. T 11965
Monges Lopez, Ricardo 12003
Morris, George 12026
Mukhina, G. V 12047
Müller, Max 12075
Murashita, Toshio 12054

Nagata, Takeshi 11959
Nakabayashi, Kazutaka 12056
Newsom, E. G 12124
Niem, G. de 12045
Nishimura, Eiichi 11913
Niskanen, E 11914, 11915
Null, F. E 12078

Ochiai, Toshiro 12054
Okada, Atsushi 11959
Ol', A. I 11962
Olson, R. W 12083

Pacella, G. B 11933
Pajari, Yrjo 12103
Pamir, H. N 11960
Pannocchia, G 11954
Perret, F. A 11974
Plesset, E. H 12079
Pontecorvo, Bruno 12092
Pough, F. H 11976
Poulter, T. C 12034, 12035

Abstract
Pregel, Boris 12093
Press, Frank 11952, 11953
Princep Curto, J. M 11940
Purdy, W. G 12114

Querzoli, Ruggero 11970

Raggatt, H. G 11997
Ramirez, J. E 11943
Ramsey, W. H 11984, 11985
Ray, H. W 12072
Reynolds, G. T 11968
Rice, R. B 12038
Richards, T. C 12013
Ricker, Norman 12083
Rogozinski, A 12066
Rolshausen, F. W 12105
Rossi, B. B 12090

Sali, I 11922
Sans Huelin, Guillermo 11929, 11930
Santangelo, M 11966
Sato, Konosuke 12055
Savitt, C. H 12027
Schenk, Erwin 12049, 12050
Scherbatskoy, S. A 12102
Schleusener, Alfred 11924
Schoff, S. L 12021
Scholte, J. G 11946
Seale, Tom 12001
Semenov, A. S 12046
Shibata, B 12053
Shock, Lorenz 12028
Shockley, William 12122
Shore, L. G 12087
Siegert, A. J. F 12100
Silverman, Daniel 12112, 12113
Simon, R. F 12025
Slätis, Hilding 11967
Slotnick, M. M 12036
Smith, E. M 12098
Snyder, T. M 12091
Spicer, H. C 12058
Spradlin, V. E 12070
Stauffer, L. H 12091
Stead, F. W 12061
Stenz, Edward 11939
Stoneley, Robert 11944
Sucksdorff, E 11936
Swain, S. E 12105

Tainsh, H. R 12069
Tanni, L. I 11916, 11917
Tartakovskii, B. D 12022
Tikhonov, A. N 12047
Thomson, J. E 11973
Tolstoy, Ivan 11951, 11952, 11953
Tow, J. O 12104
Trappe, F 12023
Trotter, Charles 12103
Tsung, F. T 11925, 11934

U. S. Waterways Experiment Station 12040, 12041

	Abstract
Vassy, Etienne	12095
Vlodavets, V. I	11977
Vogelsang, C. A	12099
Voisin, A	12066
Volet, Charles	11911
Walls, W. S	12107
Wannier, G. H	12086
Watson, R. J	12013
Watt, B. E	12100
Wier, K. L	12014
Woo, C. C	11938
Woollard, G. P	11920
Wright, H. O	12116
Yancey, J. R	12108
Ylinen, J	11964
Yüngül, Sulhi	12048
Zettel, W	12023

Geophysical Abstracts 142 July-September 1950

(Numbers 12126-12339)

GEOLOGICAL SURVEY BULLETIN 976-C

Geophysical Abstracts 142 July-September 1950

(Numbers 12126–12339)

By MARY C. RABBITT *and* S. T. VESSELOWSKY

GEOLOGICAL SURVEY BULLETIN 976-C

Abstracts of world literature contained in periodicals, books, and patents

DEPARTMENT OF THE INTERIOR
March 3, 1849

UNITED STATES GOVERNMENT PRINTING OFFICE WASHINGTON : 1950

UNITED STATES DEPARTMENT OF THE INTERIOR

Oscar L. Chapman, *Secretary*

GEOLOGICAL SURVEY

W. E. Wrather, *Director*

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price 25 cents (paper cover). The printing of this publication has been approved by the Director of the Bureau of the Budget, February 1948.

CONTENTS

Page
Introduction 141
Earth physics 143
    Gravity 143
    Magnetism 151
    Seismology 156
    Electricity 167
    Radioactivity 168
    Heat 171
    Volcanology 172
    Tectonophysics 172
    Internal constitution 177
Exploration geophysics 177
    General 177
    Gravimetric methods 179
    Magnetic methods 180
    Seismic methods 182
    Electrical methods 185
    Radioactive methods 188
    Well logging 189
    Technical aids 191
Patents 192
    Gravity methods 192
    Magnetic methods 192
    Seismic methods 193
    Electrical methods 194
    Radioactive methods 194
    Well logging 197
    Technical aids 200
Index 207

GEOPHYSICAL ABSTRACTS 142, JULY-SEPTEMBER 1950

By Mary C. Rabbitt and S. T. Vesselowsky

INTRODUCTION

Geophysical Abstracts are prepared by the Geophysics Branch of the Geological Survey, United States Department of the Interior, as an aid to those engaged in geophysical research and exploration. Periodicals, books, and patents are regularly searched for material dealing with geophysical exploration and with basic earth physics as represented by the fields of gravity, magnetism, electricity, seismology, radioactivity, and heat.

Abstracts in this issue have been grouped in three sections dealing with earth physics, exploration geophysics, and patents. The first section has been further divided into sections on gravity, magnetism, seismology, electricity, radioactivity, heat, volcanology, tectonophysics, and the internal constitution of the earth. The section on exploration geophysics covers gravimetric, magnetic, seismic, electric, and radioactive methods, well logging, and technical aids. Within each group the order of the abstracts is as follows: general papers, bibliographies, and reviews; theory; instruments; methods and techniques; observations.

As many readers may not have ready access to the source material, an effort is made to include all significant new material in these abstracts. Where geographic names quoted differ from the decisions of the United States Board on Geographical Names, the latter are added in brackets.

Geophysical Abstracts 1–86 and 112–127 were issued as Information Circulars by the Bureau of Mines, and 87–111 were issued as Bulletins of the Geological Survey. Beginning with 128, Geophysical Abstracts are published as Bulletins of the Geological Survey.

All Geophysical Abstracts published as Information Circulars are now out of print. Geophysical Abstracts issued as Bulletins of the Geological Survey (except Nos. 87 and 88 which are out of print) may be purchased as single copies or by subscription from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. For subscription, the Superintendent will accept a deposit of $5 in payment for subsequent issues. When this fund is near depletion, the subscriber will be notified. The deposit may also be used to purchase any other publication from the Superintendent of Documents.

Acknowledgements.—Special thanks are due James R. Balsley, Jr., Roland G. Henderson, H. R. Joesting, Elizabeth King, and Isidore Zietz who have prepared the abstracts signed J. R. B., R. G. H., H. R. J. E. K., and I. Z.

EARTH PHYSICS

GRAVITY

12126. Morelli, Carlo. Il geoide e la geofisica [The geoid and geophysics]: Annali Geofis., v. 2, no. 2, pp. 251–254, 1949.

One of the most important results obtainable from the calculations connected with the tying of different geodetic networks is the possibility, at least theoretical, of determining the exact shape of the geoid and its deviation from the reference ellipsoid. This also gives some indication of the structure of the crust and the distribution of heavy masses in its upper layers. When such calculations are made for regions of irregular topography and complicated tectonics, however, the results sometimes appear paradoxical because of different reductions applied in the process of calculations. Furthermore, the assumed dimensions and the orientation of the reference ellipsoid influence the numerical values obtained for the deviations of the geoid from the reference ellipsoid. In view of possible future geophysical applications it is more advantageous to use especially in mountainous countries one geoid of large dimensions instead of several partial ones, as one for Italy, another for France, and so on.

This, of course, does not affect the purely geodetic importance of an unique ellipsoid of great dimensions, a problem which is of great interest in studies of the undulations of the geoid.—*S. T. V.*

12127. Kazanskii, I. A., The present state and the prospects of gravimetric studies of the earth in Russian]: T͡Sentral'nyi nauchno-issledov. Inst. geodezii, aeros"emki i kartografii, Trudy, no. 51, pp. 3–45, 1948.

Many problems of geophysicis can be solved only on the basis of data gathered from surveys covering the whole surface of the earth. Therefore the regional investigations of different countries ought to be coordinated in a common scheme as to their aims and methods employed. The status of gravimetric investigations of different countries is reviewed criitcally on the basis of information which, in many instances, seems to be obsolete. In the opinion of the author, the U. S. S. R. is the most advanced country as to the methods used. In its western part, the distances between the stations, with few exceptions, are 33 km., a density of one station per 1,000 sq. km. The next best gravimetric network is that of the United States, Alaska excluded, where the density of the stations is one per 6,000 sq. km. The rest of the Western Hemisphere has a rather sparse gravimetric network.

The United States is characterized by great variation of the station density in different parts of the country, and the existence of many separate areas surveyed in great detail by private concerns, primarily petroleum companies, which do not publish the findings of their investigations. Among other gravimetric networks mentioned are the networks of India, Asia, Africa, countries of the British Commonwealth, Switzerland, Belgium, Germany, Italy, North Africa, and part of China and the Philippine Islands.

Gravitational investigations made over water from on board a ship or on ice floats, such as the measurements of Russian scientists made near the North Pole, are mentioned separately. Surveys by Vening Meinesz in Dutch East Indies gave material for far-reaching scientific conclusions. Marine surveys in the U. S. S. R. during 1930–35 led to the discovery of the continuation of the Crimean ridge westward beneath the bottom of the Black Sea and established gravitational features connecting the Ural Mountains with the Donbass hills beneath the Caspian Sea.

To make a gravimetric survey which embraces the whole surface of the globe a success, it is necessary to prepare in advance a common program, to make decisions as to the instruments used, their precision, corrections to be applied, types of the reductions of readings, checking of the data, cataloging of the results in form of tables or maps. The findings of such surveys must be adapted for future needs in purely scientific works, in geology, general geodesy, geophysics, as well as in industrial exploration. The general survey must be preceded by establishment of a basic network of absolute gravitational measurements. This network must be referred not to one central station, such as Potsdam, but to an adjusted average of the determinations of several observatories such as Teddington, Washington, Potsdam, Pulkovo, and others. The types of instruments to be used and their accuracy are also discussed.—*S. T. V.*

12128. Boaga, Giovanni. Sugli errori medi delle deviazioni della verticale [Average errors in determinations of the deviation of the vertical]: Geofis. Pura e Appl., v. 16, fasc. 1–2, pp. 13–15, 1950.

A suggestion has been made that the deviation of the plumb line determined by the methods of spherical astronomy be used as an indicator of underground disturbing bodies in gravimetric surveys. Analysis of the errors which would affect such determinations indicates that in certain unfavorable cases the errors can be as much as 10°, making questionable the practical value of such determinations.—*S. T. V.*

12129. Kazanskii, I. A. Considerations on the establishment of an adjusted value of absolute gravity to be used in the universal gravimetric survey [in Russian]: T͡Sentral'nyi nauchno-issledov. Inst. geodezii, aeros"emki i kartografii, Trudy, no. 51, pp. 61–82, 1948.

Determination of the absolute value of gravity and the derivation of a standard formula for the variation of this force over the surface of the earth is one of the fundamental problems of gravimetry, important in studies concerning the shape of the earth, and as a quantity related to other basic physical constants. The Potsdam value of gravity became the internationally accepted constant in 1909, but for the last 10 years the correctness of this value has been repeatedly questioned.

The Potsdam determinations are analyzed metrologically, and the details of measurements and the applied corrections discussed. Using a different treatment of the experimental data of Kuhuen and Furtwangler, g in Potsdam is found to be 981.259±0.011 gal, rather than 981.274±0.003 gal.

A detailed analysis is made also of the gravity determinations by P. R. Heyl and G. S. Cook in Washington, by J. S. Clarke in Teddington, and by H. L. Dryden in Washington. Finally, a tying of the Potsdam, Washington, and Teddington data is attempted and a table is given of the most probable gravity values for these three points derived from all four measurements. The results are considered as tentative only.—*S. T. V.*

12130. Lozano Calvo, Luis. Determinación de una formula para la gravedad normal a partir del elipsoide terrestre de Struve, adecuada especialmente para España [The derivation of a formula for standard gravity, corresponding to Struve's terrestrial ellipsoid, with special reference to Spain]: Rev. Geofís., v. 9, no. 33, pp. 1–41, 1950.

The equation of gravity force best fitted to the Spanish gravimetric network is determined. From numerous reference ellipsoids Struve's was chosen because it was the basis of the Spanish geodetic network. As the first step in the calculations, the cartesian system of coordinates was replaced by elliptical ones and the Laplace potential equation was transformed to new coordinates. The energy of the centrifugal force of the terrestrial rotation was added to the value of the potential function obtained. The potential function thus obtained and the terrestrial ellipsoid chosen must satisfy the following conditions: the ellipsoid is an ellipsoid of revolution, its exterior surface must be an equipotential surface, and the mass enclosed must be equal to the total mass of the earth as determined by astronomical considerations. As the fourth determining condition, the sum of differences between the theoretically computed gravity force at any point and that observed in Spain must be a minimum. The summation is not extended over the whole surface of the earth but limited to Spain and the 208 Spanish gravitational stations. For every one of these the values of the standard gravity force and of the corresponding anomaly were computed.

Similar computations were repeated using the formulas of Helmert (1901 and 1915), Bowie, Cassinis, and Heiskanen. The use of Struve reference ellipsoid results in the least total sum. The results of the determinations based on Struve reference ellipsoid are presented on maps, showing the Fayé and Bouguer isoanomalies, and the curves of differences between the values of these anomalies. A table contains gravity values for points of Spanish territory as function of their geographic latitude.—*S. T. V.*

12131. Cunietti, Mariano. Collegamento gravimetrico delle stazioni di Padova, Bologna e Milano per mezzo di gravimetro Western G–4A [The gravimetric tying of the stations Padova, Bologna, and Milan using the Western G–4A gravimeter]: Riv. Geofis. Appl., v. 11, no. 1, pp. 27–36, 1950.

During February 1950, a gravimetric tie was made between the Milan and Bologna stations and at the same time the tying of the Bologna-Padova stations was repeated. The instrument used was the Western G–4A gravimeter with a constant of 0.0768. As the range of the instrument is only 90 mgal., the total gravimetric profile was divided into several smaller steps. The difference Δg between Milan and Padova was determined as 86.490 mgal. Several intermediate stations were selected so that pendulum and gravimetric determinations made previously could be compared, and in most of the intermediate stations the agreement between the Δg values determined by different geophysicists was found to be very satisfactory. Because certain discrepancies were also established, the author warns that the latest values, obtained by gravimeters, should not always be assumed as the best. Even if the gravimeters are very accurate, the determination of their constants necessitates a precision of calibration which is very difficult, if not impossible, to attain.—*S. T. V.*

12132. Gloden, Albert. Comparaison théorique de deux stations gravimétriques voisines [Theoretical comparison of two neighboring gravimetric stations]: Soc. Naturalistes Luxembourgeois, v. 42, pp. 6–9, 1948.

A gravimetric survey of the Grand-Duché de Luxembourg was made in October 1948 in which 96 stations were occupied with Paris as the base station. Gravity at Luxembourg-Athenée, central station for the country, was found to be 980.980 gals, with a probable error of ±0.1 mgal. German gravity determinations during the occupation of Luxembourg included a determination of $g=980.9772$ gal (referred to Potsdam system) with an error of less than ±0.65 mgal. for a point B near the Athenée station.

Using the Cassinis formula for the variation of gravity with latitude, and applying free air and Bouguer corrections with assumed ground density of 2.5, g for the point B of the German network was computed to be 980.977102 gal. in the Paris system, a difference of only 0.098 mgal. (*See* Geophys. Abstract 11690.)— *S. T. V.*

12133. Kilchling, Karl. Zur Eötvösschen Drehwaage [The Eötvös torsion balance]: Naturf. Gesell. Freiburg im Breisgau, Ber., Band 39, pp. 225–233, 1949.

The general theory of the operation of Eötvös torsion balance is discussed and modifications of the design employing two, three, four, and six masses, differently suspended, which make it adaptable for measuring the horizontal gradient of gravity, are analyzed.—*S. T. V.*

12134. Kilchling, Karl. Über neue Drehwaagenformen für Schweremessungen [New types of torsion balance for gravity measurements]: Gerlands Beitr. Geophysik, Band 61, Heft 2, pp. 79–85, 1950.

The general differential equation describing the operation of the torsion balance is derived under the assumption that the forces of gravity acting within the volume of the instrument on its various members are not proportional to the distances of built-in masses from the centroid of the movable system.

In this equation the third derivatives of the gravitational potential appear. By an appropriate selection of the number, size, and disposition of the masses it is possible to make the coefficients of the second and third derivatives equal either to zero or to very great values as compared with other coefficients of the equation. Therefore it is possible to design forms of the moving system of the balance that are especially adapted for direct measurement of the horizontal gradient or of the curvature.—*S. T. V.*

12135. Kilchling, Karl. Über eine Drehwage zur/Messung von U_{zzx} und U_{zzy} [A torsion balance measuring U_{zzx} and U_{zzy}]: Gerlands Beitr. Geophysik, Band 61, Heft 3, pp. 181–183, 1950.

In a previous publication (*See* Geophys. Abstract 12134) a generalized equation of the torsion balance was derived and a mechanical system determined for measuring the second and the third derivatives of the potential function U. In the present study the special case in which the coefficients of all derivatives, with the exception of U_{zzx} and U_{zzy}, are zero, is analyzed. Such a system can be employed for obtaining in three azimuthal positions of the balance three equations containing the last two derivatives and the unknown constant of the instruments. From the system of these three equations all the unknown values can be easily computed. The necessary sensitivity of the balance is also calculated and seem to be equal to that of good instruments in present use.—*S. T. V.*

12136. Grushinskii, N. P. The use of gravimeters for the measurements at stations of the first and second order [in Russian]: Sbornik nauchno-tekhnicheskikh i proizvodstvennykh statei, no. 23, pp. 16–21, 1949.

During the summer of 1948 a gravity station of the first class was established in Kiev, Ukraine, by tying this station with two base stations at Moscow and Poltava. The instruments used in the measurements were two Molodenskii gravimeters, type PG–0, two similar gravimeters type GKM–5, and four Nørgaard gravimeters. All instruments were carefully calibrated, and gravimeters having steel springs were tested for the effect of the vertical component of the earth's magnetic field. For transportation special airplanes were used. The ties between the airports in Moscow and Poltava and the local observatories were made by separate measurements, again using gravimeters.

The article contains logs of the observations, detailed calculations applying corrections for drift of the instruments, barometric and temperature variations. The gravity value at Kiev was finally determined as 981072.3±0.78 mgal.—*S. T. V.*

12137. Frolov, A. I. The effect of the vertical temperature gradient on the determination of gravity by pendulum measurements [in Russian]: Sbornik nauchno-tekhnicheskikh i proizvodstvennykh statei, no. 16, pp. 9–22, 1948.

For several years errors in gravitational measurements have been noticed at stations where determinations were made during winter months, especially in the northern regions of the U. S. S. R. As the explanation of these errors the supposition was advanced that temperature variation takes place along the length of the pendulum causing variation of its length. Numerous measurements made under corresponding conditions as well as with artificially increased temperature differences in the room where the instruments were installed indicated the temperature difference between the extremities of a pendulum often may be as high as 1° C. Under unfavorable conditions, the errors in the gravity measurements may be as much as 5–8 mgal. It was empirically established also that the temperature variation along the rod of the pendulum can be represented by a parabolic equation.

By measuring the temperature at extremities and assuming the parabolic variation of the temperature, it is possible to compute the change in the length of the pendulum and to apply the necessary corrections in the determinations of g.—*S. T. V.*

12138. Frolov, A. I. The dynamic temperature coefficient of pendulums [in Russian]: Sbornik nauchno-tekhnicheskikh i proizvodstvennykh statei po geodezii, kartografii, aeros''emke i gravimetrii, no. 22, pp. 35–38, 1949.

On the basis of observations of pendulum apparatus during gravity surveys in northern Siberia, it is concluded that established temperature stratification in a room or in the housing of a pendulum takes considerable time to disappear, even with external thermal conditions remaining constant. If the external temperature rises, the thermal gradient generally increases; if the external temperature decreases, the thermal gradient also may decrease where ventilation is good, but quite often becomes even greater. Therefore, the dynamic temperature coefficient cannot be computed and applied to bronze or brass pendulum instruments on the basis of readings of the external temperature. It is also impossible to compute the exact value of the dynamic temperature coefficient from measurements of temperature on different levels in the housing, although this is an improvement. It is necessary to design a thermometer indicating the integrated temperature difference over the whole length of pendulum and this thermometer should have a thermal inertia equal to that of the pendulum.—*S. T. V.*

12139. Grushinskii, N. P. The dynamic temperature effect of a gravimeter [in Russian]: T͡Sentral'nyi nauchno-issledov. Inst. geodezii, aeros"emki i kartografii, Trudy, no. 51, pp. 117–134, 1948.

The most important factor limiting the accuracy of modern gravimeters is the variation of its temperature. To attain an accuracy of 0.1 mgal. it is necessary to keep the temperature of the instrument constant within 0.01° C. and in some constructions 0.001° C. It is also essential to have the same temperature in all parts of the gravimeter, a condition which can be fulfilled only after hours of waiting before readings are taken. As long as different parts do not have the same temperature, the geometric configuration of the system is modified, and, by this dynamic temperature effect, readings of the instrument are changed.

The effect is analyzed and the necessary corrections are computed. Variation of the housing caused by the change in temperature is assumed as negligible. The most sensitive member of the system is the horizontal level, and the spring system, usually made of elinvar, is much less affected. The equalization of the temperature among various parts of the gravimeter is assumed as taking place through the exchange of heat from any element of the metallic surface to the air and vice versa in the corresponding colder parts. From these assumptions, the effect of variations of temperature on the indication of the instrument is computed, if the variation of the elasticity of the spring with temperature is known as well as the changes in the configuration of the system by thermal expansion.

The computed temperature changes of different parts were checked experimentally and the agreement between these values was found satisfactory. Readings of the instrument at the same station were also repeated at various temperatures, applying the computed corrections, and were found to be satisfactorily constant. Certain suggestions as to the design of the springs, of the thermometer and of the level are made with view of improving the operation of the instrument. It is believed that with the suggested changes in construction the precision of the gravimeter can be improved to ±0.5 mgal. without the use of a thermostat, and this can be of practical importance in surveying regions of difficult accessibility.—*S. T. V.*

12140. Schleusener, Alfred. Grundlagen der grosregionalen Gravimetermessungen für das Amt für Bodenforschung [Principles of the extended regional gravitational survey of the Amt für Bodenforschung]: Geol. Jahrb. 1943–1948, Band 64, pp. 187–199, 1950.

A regional gravimetric survey of Germany was begun in 1934 for the purpose of aiding in industrial explorations for useful minerals by giving accurate local gravity data and at the same time forming a foundation for theoretical studies of geodetic, geologic, and geophysical problems. By the end of 1945, about 40,000 stations had been measured. Distances between stations in the gravitational network ranged from 10 to 25 km. The gravimetric data were referred to the standard Potsdam system, with g=981.274 gal. This figure was later proved to be too high by 13 mgal. Different reductions to be applied to measured values are discussed in detail, especially the Bouguer reduction containing the often disputed density value. The question of choosing the best adapted reference level is also discussed.—*S. T. V.*

12141. Bollo, Robert, and Gougenheim, André. Au sujet de la variation périodique de la gravité [On the periodic variation of gravity]: Annales Géophys., tome 6, no. 2, pp. 133–135, 1950.

The total amplitude of the variation of gravity is the sum of two terms: the first, the result of the movement of the earth in its orbit and of changes in the position of the earth in relation to the sun and moon; the second, produced by the elastic deformation of the earth by forces causing the change of the earth's gravitational field. The ratio of the first component to the second is approximately 1.15 or 1.30.

On the basis of determinations made hourly at five French observatories the total amplitude was found to be 0.20–0.25 mgal. Thus the amplitude caused by the deformation of the earth is only 0.03–0.07 mgal., a quantity which is difficult to measure accurately. Microseismic disturbances often interfere with these measurements. An important feature of the wave curve representing these variations of gravity is the absence of phase displacement in the second term, pointing to a very small energy dissipation during the deformation of the earth.—*S. T. V.*

12142. Castro, Honorato de. Variaciones de la pesanter [Variations of gravity]: Asociación Mexicana de Geologos Petroleros Bol., v. 1, no. 2, pp. 163–178, 1949.

During the two weeks May 10–24, 1949, simultaneous determinations of gravity were made every 15 minutes at several selected points of the earth's surface, including three stations in Mexico, to study the deformations of the figure of the earth caused by the attraction of the moon and sun. In the present article equations are derived for the influence of these bodies on the force of gravity at a point on the earth's surface. Discrepancies between the computed and the measured values are caused by changes in the shape of the earth.—*S. T. V.*

12143. Eblé, Louis. Sur les variations de la verticale [On the variations of the vertical]: Annales Géophys., tome 6, no. 2, pp. 128–129, 1950.

From records of more than 6 years, two periods of the variation of the vertical were discovered: one equal to a lunar month, 29.5 solar days, the other equal to one-half this interval. The north-south component of the variation shows both these periods, with the semi-monthly amplitude twice the monthly one. The east-west component shows only the semi-monthly variation. This and other less pronounced peaks of the wave curve cannot be satisfactorily explained by celestial mechanics.—*S. T. V.*

12144. Skeels, D. C. Geophysical data on the North Carolina Coastal Plain: Geophysics, v. 15, no. 3, pp. 409–425, 1950.

Geophysical exploration conducted during 1944–46 by the Esso Standard Oil Co. on the Coastal Plain of northeastern North Carolina and southeastern Virginia included regional gravity, magnetic, and seismic refraction surveys, and a detailed seismic reflection survey in the Pamlico Sound area.

The gravity and magnetic maps indicate a basement of complex composition with a north-south grain, similar to that exposed in the Piedmont of North Carolina and Virginia. Most of the gravimetric and magnetic features are believed to be related to variations in the density and magnetic properties of the pre-Cretaceous basement, rather than to basement topography.

Refraction data show a high-velocity layer with an eastward regional dip. In the western part of the area this layer is identified as the crystalline basement, whereas in the eastern part it is believed to be a limestone in the lower Cretaceous series. Reflection seismic data likewise show eastward regional dip, a number of noses plunging east and northeast, and some possible faults, but no closed structures.—*H. R. J.*

12145. Carreño, Alfonso de la O. Cartas de anomalias de la gravedad en la Republica Mexicana [Maps of gravity anomalies in Mexico]: Ing. hidraulica en México, v. 3, no. 4, pp. 23–35, 1949.

On the basis of data from 168 pendulum stations and 52 gravimeter stations two maps of Mexico have been drawn, one representing the Bowie anomalies, and the other Bouguer anomalies. Tacubaya Observatory (g=978.941 gal) was used as base, and the value of gravity correlated with the U. S. Coast and Geodetic Survey base station in the Commerce Department building, Washington, D. C.—*S. T. V.*

12146. Bödvarsson, Gunnar. Um bergmyndanir undis basaltinu [On mountain making and basalt] [In Icelandic with English summary]: Tímarit verkfraeðing afélags íslands gefið út af stjórn félagsins, 34 árg., 2 hefti, pp. 11–14, 1949.

Bouguer anomalies of 7 to 19 mgal. were found along a profile between Akureyri and Grímsstadhir in northern Iceland, where values of about 30 mgal. were expected for isostatic equilibrium. As similar anomalies and excess gravity are found near Reykjavík and in Scotland, the Hebrides, Orkney Islands, and Shetland Islands, these anomalies may be regional. Small free air anomalies in Iceland suggest that the basement there consists of light continental rocks. Presence of numerous hot springs indicate an abnormal temperature gradient, to some extent caused by a high level of basaltic magma in the crust. As this magma has a greater density than normal continental rocks, the basement probably includes a thick series of light sediments. Compaction and flow of these sediments may have caused many of the faults in the basalt plateau. Accumulation of probably 10,000 feet of basalt during a relatively short time has caused a temperature rise in the rocks below, and as a consequence part of the crystalline crust has remelted and expanded 5 to 10 percent. This expansion may have contributed to the great number of dikes and fissures.—*M. C. R.*

12147. Bollo, Robert and Goguel, Jean. Mesures gravimétriques en Bretagne [Gravity measurements in Brittany]: Bur. Recherches géol. et géophys. Pub. 8, 37 pp., 1950.

A gravimetric survey was made of Brittany during June 1949 with 262 stations occupied, many of them several times. The instrument used was a North American gravimeter. The accuracy of the determinations is estimated as 0.05 mgal., necessitating application of the correction for the lunar and solar effects.

The results of the measurements and of the computations are presented in a table and a map. For every station the table gives the geographic coordinates, the altitude, computed value of normal gravity, measured value of gravity, and the Bouguer anomaly calculated with density assumed as 2.7. Bouguer anomalies are also shown on a map on the scale 1 : 600,000.

For the whole region, the average value of the Bouguer anomaly is +0.45 mgal. If Brittany is considered as a rigid block exercising uniform pressure on its base, the excess of measured gravity over that computed by the international formula, is the same order of magnitude as the effect of the far zones. Brittany may thus be considered as fully compensated.—*S. T. V.*

12148. Ku, K. G., Ceng, Youngtsen, and Chang, C. Y. Isostatic anomalies of 208 Chinese gravity stations: Chinese Geophys. Soc. Jour., v. 1, no. 2, pp. 101–139, 1949.

The results of the computations of isostatic reduction for 208 gravity stations in an area of about 750,000 sq. km. of China are presented. Gravity determinations used in the study were made by different observers between 1934 and 1939 using two Holwek-Lejay gravimeters.

Reduction tables used in computations were those of the U. S. Coast and Geodetic Survey, Heiskanen, and Vening Meinesz. Several topographic maps of the country were used as the basis of the reduction. The best and the most dependable for near topography from zone *Z* to as far as zone *K*, were the 1 : 50,000 maps prepared by the Chinese General Staff Land Survey. The contouring of these maps has been done at 20-meter intervals, fairly satisfactory for elevation readings. The Hayford-Bowie scheme of computation, as later modified by E. C. Bullard, and those of Heiskanen and Vening Meinesz were used, and three types of isostatic anomalies have been worked out. Results of the computations are presented in a table, giving for every station its geographic position, altitude, gravity value, and computed isostatic anomalies.—*S. T. V.*

MAGNETISM

12149. Benfield, A. E. The earth's magnetism: Sci. Am., v. 182, no. 6, pp. 20–24, 1950.

A review and discussion of theories of the origin of terrestrial magnetism, including those of Blackett and of Bullard and Elsasser.—*M. C. R.*

12050. Bullard, E. C. Terrestrial magnetism: Physics Today, v. 2, no. 9, pp. 6–13, 1949.

A review of theories of the origin of terrestrial magnetism.—*S. T. V.*

12151. Bullard, E. C. Electromagnetic induction in a rotating sphere: Royal Soc. London Proc., ser. A, v. 199, no. 1059, pp. 413–443, 1949.

A discussion is given of the induction of electric currents in a rotating conducting sphere surrounded by a stationary conducting shell. Although the primary purpose was to obtain results applicable to problems in terrestrial magnetism, the analytical developments cover a wider field.

Formal solutions for the magnetic field *H*, the electric field *E*, and the current density *I* satisfying the Maxwell field equations for a moving medium are tabulated according as the fields are toroidal or poloidal and according to the behavior of the solution at the origin. The process of solution subject to boundary conditions is illustrated for a sphere rotating in an insulating medium and in a uniform magnetic field. The results are extended to a rotating sphere surrounded by a conducting concentric shell and it is found that the external magnetic field is uninfluenced by the presence of the shell. Induction by stationary and rotating central multipoles as well as induction with current sources are treated. Important formulas are given from which the electromagnetic couples tending to stop the rotating sphere can be computed for various cases discussed.

The results obtained for induction in an oscillating sphere suggest that the magnetic effects of tidal motion in the earth's core will be small. The case of freely decaying fields that occur when there is no externally maintained field is discussed in terms of the normal modes. The methods of this paper can be employed to treat problems in which currents are induced in a rotating sphere in a varying field. Other extensions of the analysis are indicated.—*R. G. H.*

12152. Cagniard, Louis. Sur les phenomènes d'induction électromagnetique dans une sphère conductrice. Applications geophysique [On the phenomena of electromagnetic induction in a conductive sphere. Geophysical applications]: Univ. Toulouse, Fac. Sci. Annales, tome 8–1944, pp. 59–89, 1947.

Theoretical investigations of the magnetic field of the earth indicate that about 94 percent of its intensity is caused by internal phenomena such as electric currents traversing the core. It has also been proved that once such currents have been started, their extinction will be extremely slow. Thus, if in a very ancient epoch in its history the earth, moving through the celestial space, ran into an expanse occupied with magnetic fields, currents would be induced in the core of the earth which is endowed with high electric conductivity. These currents would continue for billions of years if the decrease of the angular momentum of the rotating earth did not cause their relatively rapid damping. As long as the currents continue, they produce magnetic phenomena identical with the known geomagnetic field.

The author starts from Maxwell's basic equations of electrodynamics and by extended mathematical computations arrives at these conclusions, but he considers them to be tentative because too many unknown variables make verification of these conclusions impossible at the present time.—*S. T. V.*

12153. Alfvén, Hannes. Discussion of the origin of the terrestrial and solar magnetic fields: Tellus, v. 2, no. 2, pp. 74–82, 1950.

Recent work has shown that a magnetic field can be greatly amplified by hydrodynamic motions. For example, the strong magnetic fields of sun spots may be explained by assuming that motions in the interior of the sun have amplified the rather weak general solar field, and in interstellar space an originally weak field can be amplified by hydrodynamic motion. By analogy, terrestrial and solar magnetic fields may be explained in terms of some sort of magneto-hydrodynamic process.

The dynamics of the field amplification and the generation of magnetic fields in celestial bodies are discussed with special reference to the earth's magnetic field. The core of the earth is considered to be the place where the magnetic field is generated. Starting from a meridional field of simple structure, the hydrodynamic motions may drag out the lines of force and effect a breeding of new lines of force directly, or the motions may at first give the field a tangential component which corresponds to a twisting of the lines of force. When this exceeds the meridional component new lines of force are bred and the meridional field amplified. In order to maintain the general field at a certain strength, the hydrodynamic motion must be supplied continuously with energy. As an alternative to Elsasser and Bullard's idea that this source of energy is in nuclear reactions, the possibility is suggested that the energy is supplied by nonuniform rotation.—*S. T. V.* and *M. C. R.*

12154. Wulf, O. R., and Hodge, M. W. On the relation between variations of the earth's magnetic field and variations of the large-scale atmospheric circulation: Jour. Geophys. Research, v. 55, no. 1, pp. 1–21, 1950.

According to the dynamo theory of the diurnal variation of the earth's magnetic field, all large-scale atmospheric motions in the electrically conducting region should in some measure affect the field and appear in magnetic records. Many of the conspicuous and even violent changes from day to day in the magnetic records of a single observatory may thus be a direct reflection of correspondingly marked changes in the atmospheric circulation, and conductivity, in the upper atmosphere over the observatory. A set of magnetic records may thus give a direct indication of upper-atmospheric wind patterns. A comparison of certain prominent features of geomagnetic data with the character of the large-scale atmospheric circulation as shown by observations in the lower atmosphere provides considerable evidence for some interrelationship. A detailed study of this relationship should lead to an explanation of certain conspicuous features of the geomagnetic variations in terms of the atmospheric circulation, and also to a deduction of certain large-scale features of the atmospheric circulation from current magnetic observations.—*I. Z.*

12155. Runcorn, S. K., Benson, A. C., and Moore, A. F. The experimental determination of the geomagnetic radial variation: Philos. Mag., v. 41, no. 319, pp. 783–791, 1950.

Distributed theories attribute the origin of the dipole component of the earth's main magnetic field to a fundamental property of rotating matter; core theories ascribe it to current systems within the core. Runcorn and Chapman have shown that for core theory the horizontal intensity increases with depth below the surface of the earth while for distributed theory it decreases. Measurements of this component in mines should make it possible to decide between the two theories. Preliminary measurements in mines in South Africa and in Lancashire in England have already been reported. The results of more extensive measurements made in three mines in England are reported in this paper. The removal of anomalous gradients is discussed in detail. The experimental results agree favorably with those predicted for core theory and do not support a distributed theory.—*R. G. H.*

12156. Maple, E., Bowen, W. A., and Singer, S. F. Measurement of the earth's magnetic field at high altitudes at White Sands, N. Mex.: Jour. Geophys. Research, v. 55, no. 1, pp. 115–126, 1950.

Experimental verification of the existence and nature of current sheets in the upper atmosphere was attempted by firing an aerobee rocket, housing a total field magnetometer, to a height of 368,000 feet and telemetering the data to ground stations. The launching occurred at White Sands because of existing facilities there. Because the instrumental error was large in comparison to the expected magnetic field of the current sheets, no positive detection of the "discontinuity" could be made. A description of the method and instrument, a diagram of the instrument layout, and graphs of altitude against time and decrease in field against time are presented. The latter curve compares favorably with that of the theoretical field produced by a dipole at the earth's center. The authors suggest that the use of the magnetometer to determine missile orientation, in conjunction with a photo-orienter located in the missile, might prove valuable in cosmic-ray studies. It is concluded that at a more favorable location, for example, the equator, detection of the magnetic field "discontinuity" of current sheets is feasible.—*I. Z.*

12157. Howe, H. H. The *u*-measure of magnetic activity. Jour. Geophys. Research, v. 55, no. 2, pp. 153–157, 1950.

The author compares the *u* measure of magnetic activity with other measures such as *C*, *K*, and *h* for each month of 1929–30. There are high correlations among *h*, *C*, and *K* but almost no correlation between any one of them and *u*. An analysis of the data is given and the numerical values of the various measures of geomagnetic activity as well as their correlation coefficients are presented in tabular form. It is concluded that the *u*-measure is not suited for its intended purpose; that it measures chiefly changes in the level of activity rather than the level of activity itself.—*I. Z.*

12158. Bartels, Julius. Remarks on Dr. Howe's paper: Jour. Geophys. Research, v. 55, no. 2, pp. 158–160, 1950.

The author agrees with the basic conclusion of Dr. Howe's paper "The *u*-measure of magnetic activity," namely, that *u* measures changes in the level of magnetic activity rather than the level of activity itself. However, the advantages of *u* as a measure for post perturbation are upheld and a comparison is made between *u* and *K* indices. It is recommended that tables similar to those by Vestine be constructed for post perturbation.—*I. Z.*

12159. Poisson, Charles. Le magnétisme terrestre à Madagascar [Terrestrial magnetism in Madagascar]: Acad. Malgache Mem., fasc. 37, 83 pp., 1949.

A collection of observations and measurements of geomagnetic elements made at different places of Madagascar from 1884 to the present.—*S. T. V.*

12160. Grenet, Gaston. Variomètre électromagnétique pour l'enregistrement des variations rapides du champ magnétique terrestre [Electromagnetic variometer for recording rapid variations of the geomagnetic field]: Annales Géophys., tome 5, no. 3, pp. 188–195, 1949.

A moving magnet placed inside a coil, if exposed to variations of geomagnetic field, induces in the coil electromotive force of an intensity sufficient to act on a galvanometer. The magnet and the galvometer thus form two coupled oscillating systems. The motion of the galvanometer may be represented by a differential equation of the fourth order. Analysis of this equation makes it possible to establish the principal characteristics of the instrument.

An appropriate selection of the shape of the magnet makes it possible to determine the influence of the geometric dimensions of the instrument on its operation, especially when the length of the magnet is great compared to its cross section. This increases the sensitivity of the instrument.

A theoretical analysis of the operation of the instrument is presented and the optimum design is determined. The apparatus has some similarity to the electromagnetic seismograph of the author (*See* Geophys. Abstract 11244).—*S. T. V.*

12161. Castet, J. Variométre électromagnétique type A [Electromagnetic variometer of the A-type]: Annales Géophys., v. 5, no. 3, pp. 214–215, 1949.

An electromagnetic variometer designed in accordance with principles developed by G. Grenet (*See* Geophys. Abstract 12160) and constructed during the field work in the Sahara using available expedient parts is described. The sensitivity of the instrument is as high as 10^{-6} gauss per millimeter of the scale which is more than necessary for the good recording of geomagnetic disturbances. The galvanometer used is a standard Leeds and Northrop instrument.—*S. T. V.*

12162. Dupouy, G. Perturbation du champ magnétique terrestre et des courants telluriques par les chemins de fer électrifiés [Disturbances of the geomagnetic field and of telluric currents by electric railways]: Annales Géophys. tome 6, no. 1, pp. 18–50, 1950.

Studies in conjunction with the French National Railways have demonstrated that disturbances on the magnetic records of the Chambon-la-Forêt Observatory may be related to traffic on the Paris-Orleans line, 28 km. away. Disturbances are greatest when the current is interrupted, as much as 5 gammas or 15 millivolts per km. Horizontal stratification in the region permits calculations in advance of magnetic disturbances resulting from a single parameter characterizing the currents along the electrified line. Calculation of telluric disturbances requires in addition knowledge of the variation of resistivity with depth. Agreement between observed and calculated values is satisfactory.—*M. C. R.*

12163. Roche, Alexandre. Anomalies magnétiques accompagnant les massifs de pépérites de la Limagne d'Auvergne [Magnetic anomalies associated with peperino massifs in Limagne, Auvergne]: Acad. Sci. Paris Comptes Rendus, tome 230, no. 18, pp. 1603–1604, 1950.

Geomagnetic measurements were made over peperino deposits in six different regions of Auvergne. In all of them negative magnetic anomalies were found, ranging from about 100 gammas where basalt is absent, to several thousand gammas where basalt dikes are present. Negative anomalies observed over these eruptive masses are attributed to remanent magnetism, opposite to the present geomagnetic field. As peperino deposits are a source of structural material, these negative anomalies may serve as good indicators in prospecting.—*S. T. V.*

12164. Weber, E. K., Gassmann, Fritz, Niggli, Ernst, and Rothersberger, Hans. Die magnetische anomalie westlich von Locarno [The magnetic anomaly west of Locarno]: Schweizer. min. pet. Mitt., Band 29, Heft 2, pp. 492–509, 1949.

An important magnetic anomaly west of Locarno, Switzerland, was discovered in 1921. A detailed magnetic survey of an area of about 100 sq. km. was made in 1944–45, with 178 stations occupied. At most of the stations both the horizontal and the vertical components of the geomagnetic vector were determined, using La Cour's QHM magnetometer and Schmidt's vertical magnetic balance. The instruments were carefully calibrated, their daily drift determined and the influence of temperature observed. The error in the measurements of the horizontal component is estimated as $\pm 20\gamma$, that of the vertical $\pm 5\gamma$. The magnitude of the established anomalies is of the order of $5{,}000\gamma$. The results of the survey are presented in a table and in two maps. A geological study aimed to aid interpretation of the results of the survey is planned.—*S. T. V.*

SEISMOLOGY

12165. Rothé, Jean. Seismes et volcans [Earthquakes and volcanoes]: 135 pp., Paris, Presses Universitaires de France, 1948.

A semipopular account in the Que Sais-je series. The subjects discussed are: macroseismic studies; seismic waves; seismicity of the earth; causes of earthquakes; and volcanoes.—*M. C. R.*

12166. Green, A. E., and Zerna, W. Theory of elasticity in general coordinates: Philos. Mag., v. 41, no. 314, pp. 313–337, 1950.

The authors seek to simplify the presentation of the theory of elasticity for finite displacements in general coordinates, through use of the tensor calculus. Three coordinate systems are used: a cartesian system for locating the points of body B_o at rest at time $t=0$; a cartesian system for the points of the body in the strained state B at time t, and a curvilinear coordinate system which moves continuously with the body as the original state B_o passes to state B at time t. The invariance of line elements under transformation is used to derive the components g_{ij}, g^{ij} and G_{ij}, G^{ij} of metric tensors from Euclidean spaces defined by B_o and B, respectively. The fundamental equations of the theory of elasticity are then expressed in terms of quantities involving these tensor components.

Since the strained and unstrained bodies are situated in Euclidean space, the components of the Riemann-Christoffel tensors ${}_oR_{ijkl}$ for B_o and R_{ijkl} for B vanish, yielding the compatibility equations. The equations of motion are presented in different forms, the most compact being that involving the covariant derivative of the components of the stress tensor. The principle of virtual work is used to establish the necessary and sufficient conditions for equilibrium. The strain energy functions are derived for the isothermal and adiabatic cases.

The authors believe the treatment is straightforward and that the methods used and the relations obtained contain many new features.—*R. G. H.*

12167. Brekhovskikh, L. M. Reflection of plane waves from stratified media [in Russian]: Zhurnal teknich. fiziki, v. 19, no. 10, pp. 1126–1135, 1949.

The problem of the reflection of plane waves is treated for any angle of incidence of the incoming wave and for all physical properties of the reflecting layer. For electromagnetic waves this is the dielectric constant, varying with the depth of the penetration of the wave, and for elastic waves, the controlling parameters are the density of medium and the acoustic velocity, both as functions of the depth of penetration of the wave into the reflecting medium.

The solution of the problem is obtained directly by determining the ratio of the amplitudes of the reflected and the incoming waves. These waves are mathematically described in complex form; their ratio gives the coefficient of reflection for the moduli and for the phase angles.

Starting with Maxwell's equations for electromagnetic waves, the equations of the incoming and the reflected waves are derived for the case when the vector of the electric field is perpendicular to the plane of incidence.

Similarly the differential wave equations for acoustic waves are written for the continuum and the expressions of the wave velocities derived for a similar angle of incidence. By forming the ratio of the amplitudes, the coefficient of reflection is obtained in the form of a differential equation of the first order. The solution of the last equation is found by Picard's method and by the procedure suggested by Försterling. The solution is obtained in the form of an infinite convergent series.

The results are applied to the special case of normal incidence for which the exact solution is known. Comparing this with the consecutive approximations of the series for differently varying characteristics of the boundary layer, the author finds differences of not more than one percent.—*S. T. V.*

12168. Brekhovskikh, L. M. Reflection and refraction of spherical waves [in Russian]: Uspekhi fizich. Nauk, v. 38, no. 1, pp. 1–42, 1949.

The method of treating the problem consists in resolution of spherical waves into plane waves, the theory of which has been previously discussed (*See* Geophys. Abstract 12167). The electrical vector of electromagnetic waves is assumed to lie in the plane of incidence, so that the electromagnetic field is fully described by Hertz's vector perpendicular to the boundary plane. For acoustic waves, the analogous physical property is the acoustic potential. A vertical dipole was assumed as the source of electromagnetic waves and a pulsating small sphere the source of acoustic waves. In resolving the spherical waves, the spherical wave can be represented as a double integral of plane waves differently oriented in space. Integration is carried out over a complex plane. Among the plane waves it is necessary to introduce also those with varying amplitudes (inhomogeneous waves), because the superposition of ordinary waves cannot satisfy the boundary conditions that the Hertzian vector equal zero at the zero point of the coordinates. The resolution of the spherical wave into a combination of plane ones can be done in many ways, and the selection of the most appropriate is made in view of the easiest way of evaluating the double integral representing this wave. This integration is also determined by the physical properties of the medium and can be simplified in special cases, such as when the boundary is perfectly reflecting, an approximation which can be often made.

Into the formula for the reflected wave enters also the term representing the boundary wave, identical with Mintrop's wave in seismic phenomena.

A detailed analysis of the solution is given, indicating possibilities of obtaining approximate solutions in certain cases. Experiments in which reflection and refraction of spherical waves can be observed and measured are also described.—*S. T. V.*

12169. Dix, C. H. Pulse propagation in two spatial dimensions: Geophysics, v. 15, no. 3, pp. 447–455, 1950.

The physical picture of plane and spherical wave propagation cannot be readily applied to cylindrical waves because the latter cannot be propagated without change of form. The problem of propagation when the principal radii of curvature of the pulse front surface are not the same is investigated in the simple case of an elastic compressional cylindrical pulse confined between two concentric circular cylinders. The appropriate differential equation is solved by a method of Riemann, and the solution expressed in terms of the resolvent kernel of a Volterra integral equation of the second kind. It is concluded that for any initially limited axially symmetric disturbance, if energy is transmitted outwards it is necessarily transmitted inwards. The discussion applies to any wave motion satisfying the cylindrical wave equation.—*R. G. H.*

12170. Press, Frank, and Ewing, Maurice. Propagation of explosive sound in a liquid layer overlying a semi-infinite elastic solid: Geophysics, v. 15, no. 3, pp. 426–445, 1950.

The Pekeris theory of normal-mode sound propagation from an impulsive point source located in the first of two liquid layers is extended to include the case of a liquid layer overlying a semi-infinite elastic solid. The mathematical theory is developed for both a harmonically varying point source and an arbitrary initial time-varying disturbance at the source. Phase and group velocity curves, as well as dispersion curves in the first and second normal modes, are presented for conditions approximating basaltic, granitic, and sedimentary bottoms.

It is found that for solid bottoms, large amplitude waves appear only after the arrival of the first shear waves; and that there is an arrival of a train of very low frequency waves travelling with the speed of Rayleigh waves in the bottom, the waves increasing in frequency and amplitude with increasing time. For both liquid- and solid-bottom theory, a high-frequency wave travelling with the speed of sound in water arrives riding on a low-frequency rider wave; the water waves and the rider waves merge to form a train of waves of large amplitude that is known as the Airy phase. The frequency of the latter is determined by the depth of water and the elastic structure of the bottom. The ideal location of geophones and hydrophones is discussed in the light of the theory.—*R. G. H.*

12171. Thomson, W. T. Transmission of elastic waves through a stratified solid medium: Jour. Applied Physics, v. 21, no. 2, pp. 89–93, 1950.

The transmission of a plane elastic wave at oblique incidence through any number of parallel solid layers of different material and thickness is studied theoretically. The equations for displacements and stresses in a medium are used together with the continuity of particle velocities and normal and shear stresses at the interfaces to derive an expression for quantities in the *n*th layer in terms of quantities in the first layer. Matrices are used to systematize the analysis and facilitate computations. The results are used to determine the reflection and transmission coefficients in several special cases.—*R. G. H.*

12172. Sezawa, Katsutada, and Kanai, Kiyoshi. On the propagation of Rayleigh waves in dispersive elastic media: Tokyo Imp. Univ. Earthquake Research Inst., Bull., v. 19, pt. 4, pp. 549–553, 1941.

Studies of the propagation of dispersive Rayleigh waves (*See* Geophys. Abstract 5795) are extended to the case of a homogeneous, nonstratified medium, characterized by the presence of a reactive force which is proportional to the displacement of the point. Differential equations of wave motion are derived and expressions given for the velocities of different waves. These equations show that Rayleigh waves in a semi-infinite medium of the assumed properties will be dispersive. It is concluded also that in certain elastic media the velocity of propagation of Rayleigh waves will increase with the wave length.—*S. T. V.*

12173. Valle, P. E. Effetti dell' attrito interno sulla propagazione delle onde di Love [Influence of internal friction on the propagation of Love waves]: Annali Geofis., v. 3, no. 1, pp. 47-57, 1950.

The effect of internal friction, causing loss of energy on the propagation of Love waves is studied for a medium consisting of a homogeneous layer over infinite semispace. By forming the expressions of mechanical stresses for frictional losses in the medium and assuming identical velocities of the propagation in the upper layer and in the supporting semispace, it can be shown that stratification alone produces a normal dispersion of the wave, and energy losses cause anomalous dispersion. This anomalous dispersion is, however, not very pronounced when the period of the wave is great. The damping coefficient increases rapidly with frequency. If the thickness of the upper layer and the frequency of the wave are not high, the damping is approximately proportional to the thickness and inversely proportional to the square of the period. If the thickness or the frequency is high the damping becomes the function of the period of the wave alone. Computed values are in agreement with those derived from observations.—*S. T. V.*

12174. Valle, P. E. Sulla misura della velocità di gruppo delle onde sismiche superficiali [Determination of the group velocity of surface waves]: Annali Geofis., v. 2, no. 3, pp. 370–376, 1950.

The theory of the measurement of the group velocity in the spectrum of unidimensional surface waves is developed and a formula is given for its calculation. Proof is also presented of the impossibility of determining the velocity of a specific phase in this spectrum from the observations of the incoming waves at two stations.—*S. T. V.*

12175. Antsyferov, M. S. The secondary resonances of a seismograph with spring suspension [in Russian]: Akad. Nauk SSSR Izv., Ser. geog. i geofiz., v. 14, no. 4, pp. 317–333, 1950.

The critical frequencies of a seismograph are computed with special attention to higher harmonics. The supporting spring of the instrument is assumed to have continuously distributed mass.

Starting from the known solution of the vibratory motion of such a spring, the movement of the extremity carrying the inertia mass is analyzed in detail and the conditions of the invariability of the magnification factor of the instrument are discussed.

Critical frequencies of five component harmonics besides the fundamental frequency are determined, and simpler formulas for their approximate computation are derived. The errors of these approximations are also evaluated. Such frequencies as those when the ends of the spring system vibrate in phase with equal amplitudes and therefore with no displacement in relation to one another are also discussed.

Finally, curves are constructed for several seismographs representing the amplitudes of their vibrations as functions of frequencies of disturbing impulses, and these curves compared with those obtained experimentally.

Certain recommendations concerning the construction of the instruments such as the configuration of the springs, means of an effective damping of critical amplitudes, are included.—*S. T. V.*

12176. Sezawa, Katsutada, and Kanai, Kiyoshi. On the initial movement of a seismograph subjected to an arbitrary earthquake motion, solved with operational calculus, pt. 2: Tokyo Imp. Univ. Earthquake Research Inst. Bull., v. 19, no. 3, pp. 443–457, 1941.

Previous studies (*See* Geophys. Abstract 6805) are extended to more complicated shapes of ground movement, such as linear and parabolic displacements as well as simpler cases of repeated movement, which lead to free and forced oscillations.

Model experiments conducted on a vibrating table, which received a sudden jerk of sinusoidal character are described. The observed movement of the pendulum was in agreement with the theoretical results. Certain discrepancies are attributed to the fact that conditions of the experiment do not fully reproduce the assumptions of theoretical analysis. The resulting movement of the pendulum was always in the sense opposite to that of the ground motion.

The Laplacian transformation was applied in mathematical treatment of the problem. The resulting pendulum motion is determined by corresponding integrals in the complex plane. By evaluating these integrals and assuming different degrees of damping in the system, the corresponding greatest displacements of the pendulum were obtained.—*S. T. V.*

12177. Oliphant, C. W. Comparison of field and laboratory measurements of seismic velocities in sedimentary rock: Geol. Soc. America Bull., v. 61, no. 7, pp. 759–788, 1950.

Field measurements of velocities were made in Osage County, Okla., using a single three-component seismometer successively positioned at different horizontal or vertical distances from the shot point. Cores from relevant parts of the section were later studied in the laboratory and their resonant frequencies for forced vibrations in longitudinal and torsional modes determined. The effects of water content, pressure, and temperature as well as measurement frequency and amplitude were also determined so that conditions of laboratory-velocity measurements could be corrected to those of the rock in place. Velocities of $V_P=9{,}200\pm300$ ft./sec. and $V_S=5{,}000\pm200$ ft./sec. were measured in an upper layer of Permian sand and shale approximately 250 feet thick, and $V_P=14{,}000\pm400$ ft./sec. and $V_S=9{,}900\pm300$ ft./sec. in a lower, inhomogeneous layer of limestone. After correcting to the most probable conditions of water content, pressure, and temperature for the rock in place, 17 core specimens from 8 closely spaced horizons in the limestone gave the following bimodal distribution of laboratory velocities: $12{,}600<V_P<14{,}500$ ft./sec.; $8{,}100<V_S<8{,}600$ ft./sec.; $18{,}400<V_P<20{,}400$ ft./sec.; $9{,}500<V_S<10{,}100$ ft./sec.

The following conclusions are drawn: *SV* waves can be generated by a small dynamite blast in sedimentary rocks if the shot hole is shallow and high confining pressures are avoided; *SV* velocity can be determined with approximately the same accuracy as *P* but the transmission path is subject to greater uncertainties; water content is the most important independent variable affecting velocities in near-surface Permian limestones; the Neva limestone may be subdivided on the basis of density and laboratory velocities into two types of alternating microlayers; and under conditions of this work, elastic parameters and Poisson's ratio computed from field measurements differ significantly from those determined by laboratory measurements.—*M. C. R.*

12178. Coulomb, Jean, and Molard, Pierre. Ondes séismiques au fond de la mer des Antilles [Seismic waves over the bottom of the Caribbean Sea]: Annales Géophys., tome 5, no. 3, pp. 212–214, and tome 6, no. 1, p. 65, 1950.

Attention is called to a phase with average period of 0.49 sec. in the coda of certain earthquake records at the Morne des Cadets seismological station. For 16 earthquakes, at epicentral distances of 1,000 to 2,750 km., the average velocity of these waves across the Caribbean Sea was 1,854 m./sec., somewhat higher than the velocity of sound in water. It is suggested that this is a transverse wave propagated through the bottom of the Caribbean Sea. The waves are apparently the same as the *T* waves described by Linehan.—*S. T. V.*

12179. Martin, Jean, and Joset, Alain. Anisotropie de la vitesse des ondes seismiques dans les glaciers due Groenland [Anisotrophy of the velocity of seismic waves in the glaciers of Greenland]: Annales Géophys., tome 5, no. 4, pp. 331–332, 1949.

Measurements of the velocity of seismic waves made in one of the glaciers of Greenland during the French Polar expedition in 1949 indicated a considerable difference in different directions. The maximum velocity of about 3,600 m./sec. was found in the direction of the descending movement of the glacier while the lowest velocity of about 3,200 m./sec. was perpendicular to it. Deep cracks parallel to the direction of greatest velocity, or mechanical anisotropy caused by inequality of the compression, may have produced this anisotropy of ice.—*S. T. V.*

12180. Giorgi, Maurizio. Sui periodi della fase massima di terremoti lontani [Periods of the maximum phase in distant earthquakes]: Annali Geofis., v. 1, no. 1, pp. 116–125, 1948.

Principal characteristics of the strongest seismic waves are considered, with special attention to the question of their periods, as registered during earthquakes of great epicentral distances. An explanation is suggested of the fact that the periods of these remote waves, as for instance of the W_{II} waves, approach 16 seconds.

Data on those waves, taken from the records of early 1946, are presented. They confirm the results obtained by several seismologists who are studying this question.

As an important feature of the waves arriving at Rome Observatory, the fact is mentioned that with the same epicentral distance the periods of the waves arriving from the east are greater than those coming from the Western Hemisphere crossing the Atlantic Ocean.—*S. T. V.*

12181. Menis, S., and Morelli, Carlo. Contributo allo studio della cosidetta "fase principale" di un sismogramma [Contribution to the study of the so-called "principal phase" of a seismogram]: Annali Geofis., v. 2, no. 4, pp. 545–575, 1949.

Investigation of the physical nature of the waves forming the so-called principal phase of a seismogram led to the conclusion that they consist of Love waves and do not include waves predicted by Rayleigh's theory. To see if the Rayleigh waves are perhaps secondary components in the wave spectrum, the seismograms of the earthquake in Japan of November 18, 1941, and that in Peru, August 21, 1942, were analyzed for their component waves by Vercelli's method. Again only Love waves, or surface waves normal to the principal plane and having a vertical component, were found. The existence of such waves was predicted by the theory of Somigliana. The elliptical trajectories of these oscillations and the observed rotation of their axes may be caused by a phase difference between the component waves and the change of the phase angle by reflections and refractions along the path of the waves caused by surfaces of discontinuity in the upper layers of the earth's crust.—*S. T. V.*

12182. Aliverti, Giuseppina, and Solaini, Luigi. Sulla velocità di propagazione delle onde sismiche su brevi percorsi superficiali [The velocity of propagation of seismic waves over short distances]: Riv. Geofis. Appl., v. 11, no. 1, pp. 3–13, 1950.

Records of several bomb explosions at distances ranging from a few kilometers to more than 24 km. recorded on the Pavia Geophysical Observatory seismographs during the war showed extremely low velocities of propagation of longitudinal and transverse waves. A seismic investigation was made over a profile about 1,600 meters long in the vicinity of the observatory. The aim of the observations was to measure the interval of time necessary for the arrival of seismic waves, to determine the velocity of propagation of these waves and their path, to determine the depth of penetration and to study the sharpness of the seismograms. Western Geophysical Company geophones with a natural frequency of 8 c. p. s. and the damping coefficient of 0.61 were placed at an average distance of 100 meters apart and the depth of the shot holes was 2 meters. A velocity of 0.55 km./sec. was found in a surface layer which had a thickness of only 4 meters, presumably equal to the depth of the water table. Two deeper layers had velocities of 1.58 and 1.65 km./sec. The velocity in the second layer was tentatively computed increasing according to the equation $v=1580+0.73\,z$ m./sec., z being the depth in meters.

The depth of penetration of the seismic waves was estimated as 150 meters. The thickness of the upper very low velocity layer may vary with the seasons of the year, depending on the precipitation of the preceding weeks.—*S. T. V.*

12183. Lehmann, Inge. On two explosions in Danish waters in the autumn of 1946: Geofis. Pura e Appl., v. 12, pp. 145–161, 1948.

Explosions in ammunition sunk into the sea off the Danish coast were recorded at the København, Lund, and Göttingen observatories. Records of two such explosions are described in detail and compared with that of an earthquake.—*M. C. R.*

12184. Bartels, Julius. Wissenschaftliche Ergebnisse der geophysikalischen Beobachtungen der Sprengung auf Helgoland [Scientific findings from the geophysical observations of the Helgoland explosion]: Geol. Jahrb. 1943–48, Band 64, pp. 201–203, 1950.

Carefully organized observations during the Helgoland explosion on April 18, 1947, have clarified many questions concerning the structure of the earth's crust to a depth of 40 or 50 km. Seismic waves, produced by this explosion and accurately recorded, penetrated the ground deeper than ever before, attaining a velocity of about 8 km./sec. The upper boundary of the layer carrying these waves was at a depth of 26±2 km. The mechanical energy involved in seismic waves by this explosion is calculated as equal to 10^{17} ergs, whereas the total thermal energy of the explosives used was about 1.3×10^{20} ergs. The similar explosion produced by an atomic bomb on Bikini evolved a mechanical effect equal to about 10^{19} ergs, comparable with a natural earthquake of 5.5 magnitude.—*S. T. V.*

12185. Reich, Hermann. Geologische Ergebnisse der seismischen Beobachtungen der Sprengung auf Helgoland [Geological results of the seismic observations of the Helgoland explosion]: Geol. Jahrb. 1943–48, Band 64, pp. 243–266, 1950.

Seismic observations of the Helgoland explosion of April 18, 1947, provided important evidence on the structure of the continental shield. This was found to consist of three separate layers. The uppermost is a layer of granite, the seat of the most important thermal anomalies caused by radioactivity and physico-chemical processes, about 10 km. thick or less. The next layer is gabbro, characterized by greater mechanical strength and by less-marked faulting. This layer is the source of eruptive products brought to the surface by volcanic activity. It overlies the third, peridotite, layer.

The discontinuous character of the stratification of the crust of the earth was shown by the form of the travel-time curve which is not a curved line, but a combination of straight segments. The velocities of seismic waves determined by these observations were 5,400 m./sec. in the upper layer, 6,400 m./sec. in the middle layer, and 8,200 m./sec. in the lowest one. The depth of the granite layer is about 10 km., that of the gabbro about 30 km., and that of the peridotite undetermined.—*S. T. V.*

12186. Pettersson, Hans. Exploring the ocean floor: Sci. Am. v. 183, no. 2, pp. 42–44, 1950.

An account of the 1947–48 expedition of the Albatross (*See also* Geophys. Abstract 11781). Some 200 deep-ocean sediment cores with total length of more than a mile, records of 400 depth charges indicating thickness of sediments, several thousand water samples, tens of thousands of temperature measurements to great depths, and echograms for 17,000 miles of ocean bottom are included in the data obtained.—*M. C. R.*

12187. Ewing, Maurice, Worzel, J. L., Hersey, J. B., Press, Frank and Hamilton, G. R. Seismic refraction measurements in the North Atlantic Ocean basin: Seismol. Soc. America Bull., v. 40, no. 3, pp. 233–242, 1950.

A reversed refraction profile was made at 34° N. lat., 66°30′ W. long. 120 miles northwest of Bermuda, in 2,800 fathoms of water. A velocity of 24,800 ft./sec. (7.58 km./sec.) may represent the lower part of the intermediate layer or the basement. No velocity was determined for the sedimentary cover. Using 5,600 ft./sec. (1.70 km./sec.) for this layer a thickness of 4,500 ft. was computed. (*See also* Geophys. Abstract 11730).—*M. C. R.*

12188. Ewing, Maurice, Worzel, J. L., Steenland, N. C. and Press, Frank. Geophysical investigations in the emerged and submerged Atlantic Coastal Plain: Part V. Woods Hole, New York, and Cape May Sections: Geol. Soc. America Bull., v. 61, no. 9, pp. 877–892, 1950.

Three seismic refraction profiles along lines approximately perpendicular to the trend of the continental shelf and extended to the edge of the shelf were made near Cape May, N. J., New York, N. Y., and Woods Hole, Mass. Six sea stations were occupied on the Woods Hole and New York profiles and four on the Cape May profile. Reverse profiles were made at all stations. An unconsolidated layer with velocity of about 5,800 ft./sec., a semiconsolidated layer with velocity about 11,500 ft./sec., and a layer considered to be the basement with velocity about 18,000 ft./sec. were found in each traverse. On the Cape May traverse the thickness of the sedimentary column increases from 5,000 feet near the beach to about 16,000 feet near the edge of the shelf. The basement gradually deepened seaward on the Woods Hole profile. Seaward dips of approximately 6° and 4° were found about 10 miles offshore on the Cape May profile and about 30 miles offshore at New York. On both these profiles the basement deepened gradually seaword beyond these slopes, then reversed, shoaling somewhat toward the seaward ends.—*M. C. R.*

12189. Di Filippo, Domenico, and Marcelli, L. La "magnitudo" dei terremoti e la sua determinazione nella stazione sismica di Roma [The magnitude of earthquakes and its determination at the Rome seismological station]: Annali Geofis., v. 2, no. 4, pp. 486–492, 1949.

A formula for determining the magnitude of an earthquake was derived for use at the Rome station by using data on 65 earthquakes for which magnitudes had been determined at Pasadena and Strasbourg. The formula ($M = \log A + 1.526 \log \Delta + 2.439$) is valid for distances greater than 15°.—*S. T. V.*

12190. Gutenberg, Beno. Earthquakes in North America: Science, v. 111, no. 2883, pp. 319–324, 1950.

The principal zones of seismic activity in the world and of North American earthquakes are briefly reviewed. Statistically speaking, about 5 great shocks (magnitude $\geqq 7\frac{3}{4}$) and 18 major earthquakes (magnitude 7 to 7.7) per century can be expected in the Pacific area of the United States, about 14 great and 15 major shocks in Alaska and the Aleutian Islands, and about 11 major shocks in central, eastern, and northern North America. Investigations of the direction of movement during shocks and of the relation of earthquakes and aftershock sequences contribute data on processes leading to earthquakes, but, it is pointed out, hypotheses concerning the structure and process in the earth's crust have become less certain as data accumulate and the number of recognized unsolved problems is increasing.—*M. C. R.*

12191. Mihailovič, Jelenko. The seismicity of the Balkan Peninsula [in Serbian with summary in French]: Annales Géol. Péninsule Balkanique, tome 18, pp. 187–202, 1950.

This is a review of the more important earthquakes of the Balkan Peninsula and the Aegean Sea from 479 B. C. to the present time. In this long series of seismic cataclysms there was an interval of 154 years (1084–1236) of seismic calm.

Of the epicenters of the earthquakes, 87 are located in the basin of the Sea of Marmara, 110 in the Aegean Sea, 207 on the eastern shore of the peninsula, 113 on the western coast, and 53 in the interior of the peninsula. The eastern earthquakes were caused by tectonic movements connected with the submergence of the Aegean Sea, which has left the structure of the area in a very unstable state. The Mediterranean geosyncline, a continuous process, but of insignificant intensity.—*S. T. V.*

12192. Nedeljkovič, R. L. The seismicity of Banat [in Yugoslav with summary in Russian and French]: Annales Géol. Péninsule Balkanique, tome 18, pp. 203–218, 1950.

Since 1865, 314 earthquakes have occurred in the Banat region, of which 208 epicenters have been located there. The intensity of several shocks reached degree 8 and 9. The sources of seismic energy can be divided into two distinct classes, some of the earthquakes being caused by phenomena taking place deep in Pannonian Basin, others being caused by dislocations in the higher layers. Five separate periods of seismic activity, each embracing several shocks, were recorded in this region. The earthquakes are seldom accompanied by brontides.—*S. T. V.*

12193. Uzelač, Miroslava. Seismic characteristics of the Srem region [in Serbian with summary in French and Russian]: Annales Géol. Péninsule Balkanique, tome 18, pp. 219–230, 1950.

The region studied is the valley of the lower Sava, covered with Neogene and Quaternary sediments, over which rises the ridge of Fruška Gora composed of Paleozoic schists and of upper Cretaceous formations. Earthquakes of the Srem region, as recorded from 1739 up to the present, originate in this ridge, which stretches for some 80 km. in a northwesterly direction. The principal seismic area is limited by Beočin, Crveni Čot, Jazak, Sremski Karlovci, and Krušedol. Several earthquakes of destructive intensity and of a pronounced local character occurred here. Two loci of hypocenters of these earthquakes have been found, one in the Paleozoic mass, the other in dislocations of the Tertiary and Quaternary sediments.—*S. T. V.*

12194. Fontseré, Eduardo. Los temblores de tierra Catalanes del año 1945 [Earthquakes in Catalonia during 1945]: R. Acad. Cien. y Artes de Barcelona, Bol. 34, pp. 373–378, 1946.

During 1945 only three relatively important earthquakes occurred in Catalonia: on July 9, a weak local shock; on July 17, a shock of intensity 3–4 on the Mercalli scale with epicenter about 125 km. southwest of Barcelona; on October 22, a shock of maximum intensity 4 with epicenter 144 km. from Barcelona near the village of Llesúy.—*S. T. V.*

12195. Fontseré, Eduardo. Los temblores de tierra Catalanes de los años 1946 y 1947 [Earthquakes in Catalonia during 1946 and 1947]: R. Acad. Ciencias y Artes de Barcelona, Bol. 36, pp. 73–78, 1949.

Ten earthquakes were observed during 1946 and 1947 in Catalonia, only one reaching intensity 4. Most of them were of local origin, but the epicenter of the shock of December 13, 1947, was in southwestern France, some 190 km. from the Fabra Observatory at Barcelona.—*S. T. V.*

12196. Gimeno Riutort, Antonio. Movimientos sismicos en España durante 1947 [Seismic events in Spain during 1947]: R. Soc. Española Historia Nat. Bol., v. 47, no. 7–8, pp. 485–494, 1950.

Of the 206 earthquakes which occurred in Spain during 1947, 29 were felt and 177 were registered only by seismographs. One earthquake reached intensity 6, six were of intensity 5, and six of intensity 4. Southern Spain has shown greatest seismicity with many earthquakes having their epicenters beneath the Mediterranean Sea.—*S. T. V.*

12197. Ylanan, C. W. The northern Luzon earthquake December 29, 1949: The Philippine geologist, v. 4, no. 2, pp. 1–16, 1950.

The Luzon earthquake of December 29, 1949, reached an intensity 8 near its epicenter. The epicenter was located instrumentally near 17°00′ N. lat., 121°38′ E. long. More than 50 aftershocks were felt, some of them from a different epicenter. The earthquake was of tectonic origin, no volcanic activity being noticed in connection with it. The report contains a brief seismic history and description of the geology of the island of Luzon.—*S. T. V.*

12198. Parker, G. G., and Stringfield, V. T. Effects of earthquakes, trains, tides, winds, and atmospheric pressure changes on water in the geologic formations of southern Florida: Econ. Geology, v. 45, no. 5, pp. 441–460, 1950.

Small fluctuations of water level in wells may be caused by tides, atmospheric pressure, winds, earthquakes, and passing trains, and will often mask fluctuations caused by ground-water movements or changes in storage in an aquifer. Artesian aquifers respond to barometric changes and tidal loading in varying amounts depending on their elasticity and compressibility. Nonartesian aquifers such as the shallow wells of the Miami area are affected by tides, but only under special geologic conditions by barometric changes. Wind may produce minor variations in barometric pressure in the well housing. Earthquake waves from all parts of the world produce marked fluctuation. The greatest fluctuation observed was 4.5 feet in a Miami well during an earthquake 750 miles away. Heavy trains occasionally cause similar though not as symmetrical fluctuations of a minor nature.—*E. K.*

12199. Werner, P. W., and Sundquist, K. J. On hydrodynamic earthquake effects: Am. Geophys. Union Trans., v. 30, no. 5, pp. 636–658, 1949.

This paper discusses the hydrodynamic effect of horizontal earthquake action for the most common types of artificial hydraulic vessels with rigid walls. The mathematical theory is presented for the case of two- or three-dimensional flow assuming the earthquake to be manifest in harmonic vibrations either parallel or transverse to the direction of the generating axis. The expressions for the displacement and the dynamic water pressure are obtained by finding solutions of the general differential equation of a compressible fluid which satisfy the prescribed boundary conditions. The pressure on the walls is calculated and the results presented in diagrams for various ratios of the configuration dimensions and for particular compressibilities. The conditions for resonance are discussed for the various cases. A graphical procedure with illustrations is given for the two-dimensional flow of an incompressible fluid.—*I. Z.*

12200. Coulomb, Jean. L'agitation microséismique [Microseisms]: Annales Géophys., tome 6, no. 2, pp. 115–116, 1950.

Different phenomena are often meant by the term microseisms. A sensitive seismometer of short natural frequency installed near a city or industrial center records seismic waves of a period of a fraction of a second, which almost disappear on holidays and during the night. Gusts of wind may produce microseisms of a period of 15 or more seconds and of a very irregular shape. Surf on a rocky shore also produces microseisms, and the freezing of the ground around an observatory at distances to 200 km. will cause irregular microseisms of over one minute period.

The most interesting microseisms are those of 4- to 10-second period usually noticeable during several days in succession and reaching their greatest intensity during winter months. These microseisms consist of progressive waves with a velocity from 1.9–2.7 km./sec. formed around barometric lows, whose position can be determined by observations of tripartite stations.

These microseismic waves are in the main Rayleigh waves, but very seldom appear in pure form because of reflections on the surface layers of the ground.

The propagation of these microseismic waves over continents or over oceans is different. Certain investigators think these waves attain their maxima over continental shelves where a change of frequency is observed.— *S. T. V.*

12201. Hardtwig, Edwin. Die Bodenunruhe oder Mikroseismic [Ground unrest or microseisms]: Forschungen u. Fortsch. Jahrg. 24, Heft 9–10, pp. 113–117, 1948.

A review of the various kinds of microseisms and theories of their origin.— *S. T. V.*

12202. Lynch, J. J. An investigation of two-second microseisms associated with cold fronts and a new method for tracking the cold front center: Am. Geophys. Union Trans., v. 31, no. 4, pp. 525–528, 1950.

Studies of two-second microseisms at Fordham University are reveiwed (*See also* Geophys. Abstracts 11281, 11282). Evidence is presented for a microseismic source southwest of New York and of wave trains identifiable between two stations 6 miles apart with a velocity of less than 1 mile a second. A method is being worked out in which the microseisms are recorded on an oscilloscope and the phase difference between pairs of stations read along the axis of the observed Lissajous ellipse.—*M. C. R.*

ELECTRICITY

12203. Kebuladze, V. V., and Bukhnikashvili, A. V. Organization of the daily and short cycle variations of telluric currents at Dusheti [in Russian]: Akad. Nauk SSSR Izv., Ser. geog. i geofiz., v. 13, no. 5, pp. 440–454, 1949.

Since 1947 continuous registration of telluric currents has been made. Twenty-one profiles about 1 km. long and 50 meters apart were recorded. Before continuous observations of regional telluric currents were made, the chosen area was thoroughly explored for possible local magnetic anomalies, for the presence of disturbing currents from industrial or other origins, and for the sources of geochemical generation of potential differences. Four hundred and ninety determinations of electrical resistivity were made at different points of the area and

1,000 measurements of the potential differences. No local anomalies of magnetic or electric properties were found. Comparison with the magnetograms of the Dusheti Magnetic Observatory indicates a close correlation between the variation of the latitudinal component of the telluric currents and the variation of the horizontal magnetic vector. Either of the phenomena can be represented by a sinusoidal curve with maxima near 2–3 hours and 16–17 hours and minima near 23–1 and 8–9 hours, local time.—*S. T. V.*

12204. Schmitz, H. P. Zur Interpretation von Erdstrommessungen [Interpretation of earth-current measurements]: Zeitschr. Meteorol., Band. 2, Heft 7–8, pp. 210–216, 1948. (Reviewed by H. G. Macht, Jour. Geophys. Research, v. 54, no. 1, pp. 69–70, 1949.)

A theoretical study of earth currents in the light of principles of electrodynamics and observations on underground cables shows that considerable additional electric fields may be generated at crustal boundaries, especially at shores, and also by external potential fields, such as the daily geomagnetic variations. Both types of fields are examined mathematically, and it is found that the primary magnetically induced field is equal to, or even smaller than, the partial field due to electrostatic boundary effects. Possible existence of such additional geoelectric fields makes it necessary to take them into account in measurements of earth currents. Although the ratio between the currents in the soil and in the cable used for measurements generally equals that of the corresponding conductivities, this does not hold for additional fields in the soil and in the cable when the conductivity of the soil varies along the length of the cable. It is therefore preferable to make measurements of earth currents in homogeneous soil and to use short cables. In heterogeneous ground, relative measurements of such currents over long cables are unreliable, and absolute determinations over long cables are useless.—*M. C. R.*

12205. Poldini, E. Interprétation tectonique des variations du champ tellurique [Tectonic meaning of the variations of the telluric field]: Schweizer. Vereinigung Pet.-Geologen u. Ing., Bull., v. 17, no. 52, pp. 1–4, 1950.

Telluric currents are defined as electric currents which can be observed spreading over the earth's surface with regular variations of direction and intensity. Produced by planetary influences, their patterns over a given region are influenced by the geological structure of the underground.

Typical examples are given of local patterns such as those to be found over an upwarping of a nonconductive underground stratum, over an intrusion of a nonconductive bed in a conductive series of marl, over a folding formed of diapyric salt, or over a calcareous bed topped by erosion and covered in later transgression. More complicated patterns of telluric currents and their tectonic interpretation are also discussed.—*S. T. V.*

RADIOACTIVITY

12206. Korff, S. A. Counters: Sci. Am., v. 183, no. 1, pp. 40–43, 1950.

A semitechnical account of the principles and uses of Geiger counters.—*M. C. R.*

12207. Korff, S. A. Proportional counters: Nucleonics, v. 6, no. 6, pp. 5–10, 36, 1950.

The operating characteristics of proportional counters are discussed and the conditions for optimum design determined. The amplification factors as functions of cylinder voltage and the filling gas mixture, dead-time comparison, and properties of the vacuum-tube amplifier are discussed. With an appropriate arrangement of different parts, the number of pulses per second that can be counted is at least 10 times greater than obtainable with Geiger counters operated in the conventional way.—*S. T. V.*

12208. Rohrer, R. H. A portable high-speed Geiger counter for geologic work in Georgia: Georgia Geol. Survey Bull. 56, pp. 117–129, 1950.

A modified Geiger counter has been developed at Emory University to shorten the time required for radioactivity measurements of rocks and solids. It consists of a large Geiger tube and head phones in the least expensive counting sets. Much better results can be obtained by substituting an electrically driven mechanical recorder for the head phones, or using head phones and recorders. A 3-minute observation is sufficient to obtain reliable data using the new instrument, where more than 7 hours at one station are required to attain the same reliability with standard equipment. Wiring diagrams and characteristic curves are given.—*S. T. V.*

12209. Jeffreys, Harold. On the radioactivity of potassium: Annales Géophys., tome 6, no. 1, pp. 10–17, 1950.

The rate of decay of K^{40} to Ca^{40} has been fairly well determined as $(0.51\pm0.04)/10^9$ year, but there are inconsistencies in the rate of decay to A^{40}. Ahrens' and Evans' data for the accumulation of Ca in old micas indicate $\lambda_e=(1.91\pm0.16)/10^9$ years. From Borst and Floyd's determination of A in KCl, a least possible value of $0.36/10^9$ years is determined. The amount of argon in the atmosphere may be consistent with the former value if the age of the earth is 2,100 million years and if all granites that have not been exposed retain all their argon. For greater ages, such as Holmes' estimate of 3,300 million years, λ_e would have to be less than $1.4/10^9$ years. Even the latter value would make general solidification impossible more than 1,400 million years ago unless K is more closely concentrated at the surface than usually supposed.—*M. C. R.*

12210. Guimarães, Djalma. Chronologie geologique fondée sur la désintégration atomique des minéraux radioactifs [Geologic chronology based on the atomic disintegration of radioactive minerals]: Géol. Soc. France Bull., tome 19, nos. 7–8–9, pp. 657–668, 1949.

The method of age determination of rocks based on the relation of the lead content to the amount of uranium and thorium, is often used without taking into account that quite often the parent rock was not formed as one magmatic phase but is the result of a progressive granitization. Moreover, the geochemical mobility of uranium and solubility of its oxides in alkaline carbonated complexes can cause migration of uranium and other rare elements. The use of monazite as a key mineral in age determinations is suggested as giving most reliable data.—*S. T. V.*

12211. White, W. C. and Yagoda, Herman. Abundance of N^{15} in the nitrogen occluded in radioactive minerals: Science, v. 111, no. 2882, pp. 307–308, 1950.

The isotopic ratio of N^{15} to N^{14} in occluded gases in radioactive minerals, investigated by means of the mass spectrometer, was found to be higher than in samples of atmospheric air or in nitrogen isolated from nitrogenous compounds. The percentage of N^{15} abundance seems to be roughly proportional to the geological age of the mineral. It is suggested that the nitrogen was present at the time of formation of the mineral and that the N^{15} abundance was increased by the more rapid diffusion of N^{14}.—*M. C. R.*

12212. Holmes, Arthur. Lead isotopes and the age of the earth: Nature, v. 163, pp. 453–456, 1949.

Points raised by Jeffreys (*see* Geophys. Abstract 11575) are discussed. It is indicated that some of Jeffreys' work is wrong in principle and other parts contain arithmetical errors. It is agreed, however, that further isotopic analyses are needed to improve the precision of the figures.—*M. C. R.*

12213. Szalay, A. and Csongor, Eve. Determination of radioactive content of rocks by means of Geiger-Müller counters: Science, v. 109, no. 1824, pp. 146–147, 1949.

A direct approximating method for determination of the radioactive content of rocks with Geiger-Müller counters was developed during a survey in the Velence Mountains [Velence Hegy] of Hungary. Brass counters of the self-quenching type, filled with 100 mm. argon and 10 mm. alcohol vapor, used in connection with battery amplifiers, were placed either on the surface of the rock or in a shallow borehole. A 2 mm. lead shield was used to absorb the soft components of gamma radiation. Preliminary results showed that the rock counting rate was about six times higher in the bore and two to three times higher at the surface than the cosmic radiation.

Precise formulas are developed for expressing the radioactivity in terms of thorium-gamma equivalents. For practical purposes, the following approximate formula, expressed in grams of uranium equivalents per grams of rock, may be used: $c=1.4\times10^{-5}\ J/LD$, c being the concentration of radioactive substances, J the counting rate in minutes, and L the length and D the diameter in centimeters of the brass cathode of the counter tube. For measurements on the surface, the counting rate must be multiplied by a correction factor of 2 to 2.2. If any Geiger-Müller counter of commercial dimensions shielded by 2 mm. lead is placed against the rock wall, and the observed counting rate (minus cosmic radiation) is x times the rate of cosmic radiation for the same counter, then the average uranium concentration is x times 25 g. U/ metric ton of rock.—*M. C. R.*

12214. Tiratsoo, E. N. The radioactivity of sediments, pts. 1–4: Petroleum, v. 12, no. 3, pp. 61–65; no. 5, pp. 117–122; no. 7, pp. 166–169; no. 12, pp. 313–315, 1949.

Various laboratory methods for determining the radioactivity of rocks are described, including the ionization chamber techniques in which the radon or thoron content of a rock sample is measured by releasing its gases by fusion, solution, or boiling, and passing them into the chamber for discharge in an electroscope, and the determination of potassium content in rocks and liquids by measuring beta radiation. Absorption coefficients for gamma rays in rock can be calculated from measurements made with Geiger-Müller counters of the radiation passing from a known source through progressively increased thicknesses of rock samples until no further change in count is observed. Coefficients for sandstone, shale, marl, and limestone are 0.34, 0.34, 0.11, and 0.24 for energies of about 1.50 m. e. v.—*M. C. R.*

12215. Tiratsoo, E. N. Radioactivity survey in southwest France: Am. Assoc. Petroleum Geologists Bull., v. 34, no. 4, pp. 742–754, 1950.

An investigation by measurements of gamma radiation by sensitive portable Geiger-Müller counters in a part of the Aquitaine sedimentary basin of southwest France in the summer of 1947 is described. In the coastal area between Biarritz and Saint-Jean-de-Luz, a plug of gypsiferous Keuper shale is exposed between two limestones. It has been suggested that this plug underlies the coast for more than a mile and that two fingers from it reach the surface at the Rochers de Peyreblanque and Chaillac. The objectives of the survey were to test whether the two outcrops could be proved or disproved to have a common origin, whether either or both showed an increase of radioactivity at the surface which would serve to differentiate them from the surrounding strata, and whether any trace could be found of the main body of the plug. Traverses were made from Cap Martin to Guéthary and over the supposed area of the plug. A series of stations was occupied along each line of traverse; ten minute counts were taken at each point, the apparatus being held three feet above ground. Corrections for background effect of cosmic rays were made by establishing the mean basic value of the background for each day. No evidence was found that the "ophite" outcropping at the Rochers de Peyreblanque is the same age as the plug. The Keuper plug showed remarkably high radioactivity, reaching a peak near its geographic center. Subsequent laboratory tests indicated that most of the activity was concentrated in gray marl. No evidence was found of any underlying mass along the coast, but this was expected if the mass was buried at any depth.—*M. C. R.*

12216. Hée, Arlette, Jarovoy, Michel, and Kleiber, Joseph. Study by the photographic method of active deposits of various radioactive substances: Acad. Sci. Paris. Comptes Rendus, tome 230, no. 1, pp. 1520–1522, 1950.

Colorado carnotite, Tonkin autunite, and Ceylon thorianite samples, electrically deposited on metal discs, were placed in contact with Ilford plates for periods of 4 hours to 4 days. From a statistical study of the lengths of the alpha tracks in the plates after the various times of exposure, the radioactive elements were identified.—*M. C. R.*

HEAT

12217. Birch, Francis. Flow of heat in the Front Range, Colorado: Geol. Soc. America Bull., v. 61, no. 6, pp. 567–634, 1950.

Seventy observations of temperatures from the Alva B. Adams Tunnel under Rocky Mountain National Park were reduced to find the flow of heat. Corrections have been applied for the topography on several different hypotheses regarding physiographic history. The corrected vertical gradient lies between 24° C./km. and 20° C./km., with an uncertainty of about 1° C./km. resulting from lack of reliable data on surface temperature. Laboratory measurements of 123 samples indicate a mean value of conductivity of 0.008 cal./cm. sec. deg. Variations with rock type and position along the tunnel were found to be insignificant. Heat flow is computed as between 1.6 and 1.9×10^{-6} cal./cm.^{2} sec. with a "best value" of 1.7×10^{-6} cal./cm.^{2} sec. differing significantly from normal sea-level crust values of about 1.1×10^{-6} cal./cm.^{2} sec. The difference may be accounted for in terms of mountain roots with mean radioactivity of the same order as that of granites or intermediate rocks. (For abstract published in advance, *see* Geophys. Abstract 11332.)—*M. C. R.*

12218. White, D. E. and Brannock, W. W. The sources of heat and water supply of thermal springs, with particular reference to Steamboat Springs, Nevada: Am. Geophys. Union Trans., v. 31, no. 4, pp. 566–574, 1950.

The origin of a spring system may be indicated by temperature relations, mineral content of the thermal water, composition of associated gases, variations in spring discharges and water levels, isotopic composition of spring and meteoric waters, and regional and local geology, in particular the age and extent of volcanic rocks. Evaluation of these factors with respect to Steamboat Springs indicates a volcanic origin. Measurements in thermal wells show very high temperatures at shallow depths, and computations indicate a gradient of 1° C. per 0.33 to 0.82 meters of depth, at least 40 times the normal increase. Gases evolved from the springs and the mineral content of the water suggest a volcanic origin. A structural and temporal connection with volcanism is suggested by the occurrence of the springs on the line of possible structural weakness connecting several rhyolite domes. A three-dimensional picture of the Steamboat Springs system indicates meteoric water migrates downward and toward the core of the system, with stratigraphic and structural control, where it mixes with rising volcanic water. This migration is caused by differences in density related to temperature. Artesian conditions are not essential.—*M. C. R.*

12219. Nathan, Hans. Geologische Ergebnisse der Erdolbohrungen im Bayerischen Innviertel [Geological findings from exploratory drilling for oil in the Bavarian Innviertel]: Geologica Bavarica, no. 1, 68 pp., 1949.

This is the first issue of the report on the geophysical, geochemical, mineralogical, and paleontological studies made in connection with drilling in the Innviertel. Temperature measurements made at different depths indicate the reciprocal geothermal gradient down to a depth of 150 meters varies from 15.7 to 21.1 meters; to a depth of 1,140 meters, 25.2 meters; and to a depth of 1,405 meters, 27.3 meters.—*S. T. V.*

VOLCANOLOGY

12220. Bruet, E. La Soufrière de la Guadeloupe. Contribution a l'étude des édifices volcaniques peléens [La Soufrière of Guadeloupe. Contribution to the study of pelean volcanic structures]: Annales Géophys., tome 6, no. 1, pp. 51–64, 1950.

Examination of La Soufrière casts doubt on the existence of domes in pelean structures. Erosion of deeply rooted spines has resulted in cones with slope angles of 37° at Pelée and 41° at La Soufrière.—*M. C. R.*

TECTONOPHYSICS

12221. Bucher, W. H. The crust of the earth: Sci. Am., v. 182, no. 5, pp. 32–41, 1950.

A review of the structure of the crust of the earth and of changing ideas concerning it in recent years.—*M. C. R.*

12222. Bucher, W. H. Megatectonics and geophysics: Am. Geophys. Union Trans., v. 31, no. 4, pp. 495–507, 1950.

This is the presidential address delivered at the thirty-first annual meeting of the Union. The growth of geologic thinking from the mapping of local geology to the nature of the visible part of the earth's crust as a whole is reviewed. Three basic concepts are outlined: geosynclines as loci of orogenic deformation; ultramafic rocks as initial products of orogeny; and metamorphism and granite as products of mature orogeny. It is suggested that the original crust of the earth was alkaline basalt and that the light sialic continents are the product of orogeny. Orogenic belts come into being by local failure of the crust, and the growth of continents takes place by addition at the margins.—*M. C. R.*

12223. Matschinski, Mathias. La formation des continents et des forces géodynamiques [Formation of continents and geodynamic forces]: Acad. Sci. Paris Comptes Rendus, tome 230, no. 21, pp. 1882–1884, 1950.

Cooling of the earth produced a crust over its surface. This physico-chemical transformation of the initially fluid substance was accompanied by certain secondary reheating of small absolute intensity, but important as a local tectonic factor. Forces produced by reheating were sufficient for rupturing the crust into several pieces, the future continental blocks. The spreading of the produced cracks was probably very slow and continued up to the time of the development of living matter. The continents did not drift apart, as in Wegener's theory, but simply contracted without changing the position of their centroids. Computations of the forces produced by thermodynamic processes are presented to show that these forces are sufficient for producing the rupture of the crust.—*S. T. V.*

12224. Vening Meinesz, F. A. Earth's crust deformations in geosynclines: K. Nederland Akad. Wetensch. Proc., v. 53, no. 1, pp. 27–46, 1950.

The belts of strong negative gravity anomalies in the Indonesian, Caribbean, and Japanese regions have led to the hypothesis that in these areas the earth's crust has in recent geological periods buckled downwards, forming a large bulge of crustal matter at the lower boundary of the crust. This crustal bulge, being of lower density, has caused the deficiency of mass revealed by the anomalies. The problem of how and to what extent this deformation had a plastic or elastic character is analyzed. By assuming a plastic deformation throughout the whole process, a satisfactory explanation can be given of the downbulging of the crust. At the same time, this assumption explains the intricate pattern of the belts in Indonesia and probably in other orogenic areas. The paper contains extensive calculations, based on the theory of elasticity, referring to possible buckling of a rigid crust of a thickness of 30 kilometers.—*S. T. V.*

12225. Wilson, J. Tuzo. Some major structures of the Canadian Shield: Canadian Min. Met. Bull., v. 42, pp. 543–554, 1949.

The Canadian Shield is divided into provinces that are believed to represent former mountain belts. Special emphasis is placed on radioactive age determinations, the relations of the Archean to the Proterozoic rocks, and the structure of the Grenville province.—*M. C. R.*

12226. King, P. B. Tectonic framework of southeastern United States: Am. Assoc. Petroleum Geologists Bull., v. 34, no. 4, pp. 635–671, 1950.

The tectonics of the southeastern states are dominated by the mountain system to which belong the structures of the Appalachian Highlands and Ouachita Mountains and other areas west of the Mississippi embayment, as well as structures concealed by post-orogenic coastal plain sediments of the Mesozoic and Cenozoic.

The Appalachian Highlands are divisible from northwest to southeast into five provinces which persist for great distances along the strike. On the northwest flank of the system the gently deformed Cumberland and Alleghany plateaus constitute a foreland area. The Valley and Ridge province, consisting of sharply folded and faulted Paleozoic sediments is still marginal to zones farther southeast. The Blue Ridge province is composed of metamorphosed and strongly folded older Paleozoic and pre-Cambrian rocks. The system's central axis is believed to occur in the adjacent metamorphic and plutonic zone which consists of gneisses and other thoroughly metamorphosed rocks invaded by granite plutons. A double row of ultramafic instrusive rocks in this zone and an observed southeast assymmetry of the structures on the southeast are cited as evidence. This concept is also supported by the less metamorphosed rocks of the last zone, and by the little folded and unmetamorphosed rocks beneath the Mesozoic of Florida which constitute southeast foreland of the system. The bulk of the Appalachian deformation may have preceded the Permian, contrary to the widely held concept of the Appalachian revolution. Thick wedges of clastic sediments are evidence for orogeny commencing in the Middle Ordovician.

The relations between the Appalachian and Ouachita systems are obscured by the intervening coastal plain sediments. Deep drilling in Mississippi and Alabama revealed subsurface extensions of the systems but leaves the nature of their junction uncertain. It is tentatively suggested that the Ouachita system is a westward extension of an interior belt of the Appalachian system which has been thrust northward to a moderate extent over the westward extension of the Valley and Ridge province, which may reappear as the Wichita and Arbuckle systems in Oklahoma.—*E. K.*

12227. Rodgers, John. Mechanics of Appalachian folding as illustrated by Sequatchie Anticline, Tennessee and Alabama: Am. Assoc. Petroleum Geologists Bull., v. 34, No. 4, pp. 672–681, 1950.

There is controversy as to whether the folds of the Appalachian Valley and Ridge province reach to the crystalline basement and are controlled by it, or whether they are independent of the basement, all deformation taking place within the overlying sediments. The Sequatchie anticline of Tennessee and Alabama is isolated from the Valley and Ridge folds to the southeast by a strip of horizontal plateau and, according to proponents of the first theory, must have been formed by upthrust from a competent basement. The other interpretation requires transverse faults at each end analogous to the Pine Mountain overthrust to the northeast. These faults exist, although their significance is not recognized. Transverse movement seems to have occurred along weak layers such as the Conasauga shale and buckled the overlying carbonate rocks to form the present anticline and at least two windows, comparable with the oil-bearing windows of Lee County, Va., where the thrust plane reaches the surface.—*E. K.*

12228. Weaver, Paul. Variations in history of continental shelves: Am. Assoc. Petroleum Geologists Bull., v. 34, no. 3, pp. 351–360, 1950.

A locus of tectonic movement is postulated at the outer edge of the continental shelf, rather than at a hinge line along the shore accompanied by extensive sedimentation on the shelf. The continental shelf and adjacent land seem to be a structural unit, differing only in their respective erosional agencies. The shelf is narrow where the coast rises steeply, and is correspondingly broad where there is a wide coastal plain, as illustrated by the Gulf of Mexico. There is a lack of stratigraphic evidence in the Gulf Coastal Plain for a wedge of younger sediments offshore. The continental slopes at the outer edge of the shelf are either steep, simple inclines striking lineally for great distances, or gentle, and compound inclines with less pronounced lineal character but much local relief. Both types of slope are believed to be the structural expression of downfaulting of the Gulf of Mexico with respect to the outer edge of the continental shelf. The material displaced by such a movement might have found outlet as the abundant extrusives in Mexico.—*E. K.*

12229. Emery, K. O. A suggested origin of continental slopes and of submarine canyons: Geol. Mag., v. 87, no. 2, pp. 102–104, 1950.

The temporary upbulging of the continental margins above sea level may be produced by thrusting along a shear plane at the margin, as suggested by the presence of seismic activity and negative gravity anomalies. Erosion might then incise canyons or, if long continued, even produce peneplanation before isostatic readjustment of the margins, probably by downwarping, brought about their present submergence. The Atlantic canyons were probably formed earlier than those of the Pacific.—*E. K.*

12230. Zen'kovich, V. P., and Vladimirov, A. T. Recent sinking of the coast of western Kamchatka [in Russian]: Akad. Nauk SSSR Doklady, v. 72, no. 4, pp. 753–754, 1950.

The sinking of the coast of the southern tip of Kamchatka Peninsula, determined by a recent geodetic survey, was confirmed by exploratory drilling at several places which penetrated peat deposits at a depth of over 20 meters below the ocean level and typical continental gravel conglomerates at depths of 17 to 50 meters.—*S. T. V.*

12231. Hughes, D. S., and Jones, H. J. Variation of elastic moduli of igneous rocks with pressure and temperature: Geol. Soc. America Bull., v. 61, no. 8, pp. 843–856, 1950.

Direct measurements of the dilatational and rotational elastic wave velocities in igneous rocks were made using recently developed pulse methods. Sharp, elastic pulses were excited in rocks by D. C. pulses, impressed on 5.0 mc. x-cut piezoelectric quartz crystals. The amplified output of similar detector crystals was photographed by using oscilloscopes. Two principal arrivals of energy were precisely timed, and from the travel times the dilatational and elastic velocities were computed, with an accuracy greater than 1 percent. Assuming homogeneous, isotropic media, elastic constants were then computed from the velocity data. The sample assembly was placed in a pressure cell, surrounded by an oil bath; thus measurements at high pressures and temperatures could readily be made. Measurements were made in the pressure range 1–1,100 kg./cm.^{2} and the temperature range 30–150° C. Samples of granite, quartz monzonite, diorite, andesite, and norite were studied both while enclosed in impervious copper jackets and while exposed to the fluid pressure medium. The enclosed samples had relatively great increases of velocity with pressure at the low pressures, presumably because of closing of initial pore space; the rate of increase became small and essentially linear at higher confining pressures. Open samples had small, linear rates of increase of velocity over the entire pressure range. Pressure increase was accompanied by increase of wave velocities and elastic constants in all cases. Increase of temperature was accompanied by decrease in velocities and moduli. Changes of Poisson's ratio with pressure and temperature were small and erratic.

The reasonably good agreement of the present work at effective frequencies of 2–6 megacycles with earlier measurements at low frequencies suggests that for rocks the effect of frequency upon velocity is negligible, although the data are, as yet, inconclusive.—*J. R. B.*

12232. Hughes, D. S., Blankenship, E. B., and Mims, R. L. Variation of elastic moduli and wave velocity with pressure and temperature in plastics: Jour. Applied Physics, v. 21, no. 4, pp. 294–297, 1950.

The variations in velocity of dilatational waves at pressures up to 15,000 lb/in.^{2} and temperatures from 30° to 90° C. have been measured for samples of polystyrene, Lucite, and polyethylene. The velocity of rotational waves was also measured for polystyrene and Lucite. In polyethylene no trace of a rotational wave could be identified. The computed elastic moduli and Poisson's ratio are listed in tables.

This study is very closely related to that of Geophys. Abstract 12231 in which the method of measurement is discussed.—*J. R. B.*

12233. Seigel, H. O. A theory of fracture of materials and its application to geology: Am. Geophys. Union Trans., v. 31, no. 4, pp. 611–619, 1950.

A generalized extension of Mohr's theory of fracture of materials is developed which encompasses tension as well as shear failure of isotropic media and anisotropic media having a single plane of weakness. The probability of fracture occurring across a given surface element is assumed to be a general function of the limiting normal and tangential stresses across that element in an isotropic medium and, in addition, of the attitude of that element with respect to the plane of weakness in an anistropic medium.

The probable fracture at a point in an isotropic medium is predicted to take place across a pair of conjugate surface elements equally inclined to the direction of the maximum pressure at an angle which is a function of the limiting stress as well as constants of the medium. In anisotropic media failure is predicted generally across a single surface element. Applied to geology the theory accounts for low angle thrust faults, normal faults, tear faults, tension cracks, conjugate fractures, and multiplicity of parallel shears in isotropic rock masses. It also predicts that, with increase in depth, fractures die out, low angle thrusts tend to steepen to 45°, and conjugate faults tend to become orthogonal. In isotropic rock masses, the theory predicts one parallel, rather than two conjugate parallel sets of fractures, recurrent failure along old faults under different stress distributions, and of particular interest to geologists, the lateral displacement of a new fault or shear zone by the plane of weakness previously established by an old fault or shear zone.—*J. R. B.*

INTERNAL CONSTITUTION

12234. Bethune, P. de. L'interieur de la terre [The interior of the earth]: Rev. Questions Scientifiques, pp. 389–413, July 1950.

A review of present knowledge of the internal structure of the earth.—*S. T. V.*

12235. Hardtwig, Erwin. Hypothesen über den Aufbau des Erdinnern [Hypotheses on the internal constitution of the earth]: Forschungen u. Fortschr., Jahrg. 26, Heft 9–10, pp. 123–128, 1950.

Possible causes of discontinuities in the earth, the origin of the terrestrial magnetism, and the physicochemical composition of the earth's core are discussed. The discontinuities are explained not by chemical differences of the composition, but by transition from molecular to metallic phase at a certain critical pressure. Such changes can be produced artificially on such substances as gray and white tin, yellow and metallic arsenic. They take place in the depths of the earth and produce sharp changes in the physical properties of substances involved. A check by astronomical methods of Ramsey's theoretical results applied to the planet Mars indicated good agreement.—*S. T. V.*

EXPLORATION GEOPHYSICS

GENERAL

12236. Eckhardt, E. A. Geophysical activity in 1949: Geophysics, v. 15, no. 3, pp. 400–408, 1950.

This is the report of the Committee on Geophysical Activity of the Society of Exploration Geophysicists. Although a strong downward trend in activity occurred during most of the year, on a world-wide basis geophysical activity in the petroleum industry was on a level with, if not slightly above, 1948. World-wide expenditures by the mining industry for geophysical work were about 38 percent greater in 1949 than in 1948. Expenditures for research and development were almost 41 percent greater in 1949 than in 1948.—*M. C. R.*

12237. The Geophysical Directory, 5th edition, 1950. 196 pp., Houston, Tex., 1950.

This Directory is a comprehensive listing of all companies, organizations, and individuals directly connected with, or engaged in, geophysical exploration for petroleum. Contractors doing geophysical exploration by gravitational, seismic, magnetic, radioactivity, and electrical methods, experts in soil analyses, photography from the air, drilling contractors, cartographers, and surveyors are listed as well as oil companies and individuals who used geophysical services during the years 1940–50. Foreign companies are included.—*S. T. V.*

12238. Jones, W. R., and Williams, David. Minerals and mineral deposits: 248 pp., London, Oxford Univ. Press, 1948.

A chapter on the search for mineral deposits in this book on the systematic description and methods of identification of minerals is devoted chiefly to the geophysical methods of exploration. Magnetic, gravitational, electrical, and radioactivity methods are briefly discussed. The point is made that to interpret the results effectively, it is often essential that the geologist and geophysicist work in close cooperation.—*S. T. V.*

12239. Hvoroslev, M. J. Subsurface exploration and sampling of soils for civil engineering purposes, 521 pp., Vicksburg, U. S. Waterways Experiment Sta., 1949.

This is a report on a research project of the American Society of Civil Engineers, sponsored by the Engineering Foundation, Harvard University, and the U. S. Waterways Experiment Station. It is intended to give the practicing engineer an authoritative reference work on subsurface exploration and sampling of soil and rock. Electrical and seismic methods of subsurface exploration are described. Also described is the "continuous-vibration method" which makes use of vibrations spreading through the ground produced by special vibrators capable of producing impulses of varying frequency and intensity. Most of the report covers sampling methods, including sampling in search for oil and minerals. An extensive bibliography is included.—*S. T. V.*

12240. Breyer, Friedrich. Der Salzstock von Etzel [The salt dome of Etzel]: Erdöl u. Kohle, 3rd Jahrg., Heft 7, pp. 153–162, 1950.

The history of geophysical and geological exploration, begun in 1931, of this region of Germany is summarized. The first geophysical surveys were made with torsion balance and several resulted in the discovery of gravitational maxima and minima. Later surveys were by the seismic-refraction method supplemented by exploratory drilling and with electrical well logging. Simultaneously detailed geological investigations were carried on. The results are shown as geological maps and profiles.—*S. T. V.*

12241. Ramachandra Rao, M. B. Geophysical prospecting methods: Indian Jour. Meteorology and Geophysics, v. 1, no. 2, pp. 93–104, 1950.

The development of geophysical prospecting and fundamental principles of different geophysical methods are outlined. Geophysical prospecting in India since its beginning in 1923 is reviewed and the work of the Geophysical Section of the Indian Geological Survey is described. At present the Section is working on problems of mineral and petroleum exploration and on geophysical investigations connected with hydraulic engineering and water supplies.—*S. T. V.*

12242. Wadia, D. N. The aid of geophysics in mineral exploration in India: Indian Jour. Meteorology and Geophysics, v. 1, no. 1, pp. 15–16, 1950.

Because more than 750,000 square miles in India are covered by thick alluvial silts of the Indus-Ganges river system or by ancient lava flows, the absence of outcrops of ores makes the orthodox methods of prospecting inapplicable. Modern geophysical techniques, in spite of natural limitations, are thus very important in India.—*S. T. V.*

12243. Rodriguez Aguilar, Manuel. Los problemas de la exploración en México [Exploration problems in Mexico]: Asociación Mexicana Geologos Petroleros Bol., v. 2, no. 4, pp. 231–243, 1950.

A review by the president of the association of the problems and difficulties facing the geologist, the geophysicist, and the engineer in petroleum exploration in Mexico.—*S. T. V.*

GRAVIMETRIC METHODS

12244. Oñate Espinosa, Roberto. Estudios geofisicas en la cuenca de Veracruz Geophysical investigations in the Veracruz region]: Asociación Mexicana Geologos Petroleros Bol., v. 2, no. 4, pp. 291–297, 1950.

Petroleos Mexicanos made a general reconnaissance survey of Veracruz along the shore of the Gulf of Mexico between 18° and 21° north latitude, mostly by the gravimetric method. A small area around Ignacio de la Llave was surveyed by the seismic method also. A Mott-Smith gravimeter with the thermostatic control and a torsion balance were used in the gravity survey. The total number of stations occupied is not given. The results of the surveys are presented on five maps showing isogams, gravimetric anomalies, and seismic profiles.—*S. T. V.*

12245. Closs, Hans. Zum Schwerebild der Salzstrukturen Nordwestdeutschlands [On the gravity pattern over the salt domes of northwestern Germany]: Erdöl u. Tektonik in Nordwestdeutschland, pp. 293–299, 1949.

Up to 1945 some 150,000 gravity determinations with torsion balance and gravimeter were made in an area of 100,000 sq. km. in northwest Germany. Certain findings of the torsion balance measurements regarding salt domes are presented. Four types of salt domes were found among the 170 domes so far discovered. Eighty percent of these have relatively simple gravity curves with pronounced minima over the center of the dome, 9 percent have maxima over the core of the dome, the remaining 11 percent show gravitational minima, but with a more complicated curve. Eight typical gradient curves and seismic reflection profiles obtained in these explorations are reproduced and the structure of the corresponding domes analyzed. A map of the region shows locations of salt domes of the four types.—*S. T. V.*

12246. de Sitter, L. U., Editor. Eindverslag van het geophysische onderzoek in ZO-Nederland [Geophysical survey of the southeast Netherlands] [In Dutch with condensed English translation]: Mededeelingen van de Geologische Stichtung, Ser. C, v. 1, pt. 3, no. 1, 372 pp., 1949.

Gravity and magnetic surveys of southeastern Netherlands were made during the war by the Department of Geology of the University of Leyden to investigate structural conditions in Limburg and eastern and central Noordbrabant as a base for further exploration for coal, and to trace the large faults of southeastern Limburg with as much detail as possible. An isogam map of the area was constructed from observations at 3,634 torsion balance and 214 gravimeter stations. A flat minimum trends northwestward with a rather sharp rise on both sides. The magnetic survey was made with a vertical variometer, with 333 stations occupied. No obvious connection between the variations of vertical intensity and major structural features was found. The geology of the surveyed area is described in some detail. Contributors to this report include, besides de Sitter, F. Winkelaar, W. J. Van Riel, G. Zijlstra, and A. Maaskant.—*M. C. R.*

12247. Weng, W. P. The application of gravity exploration in Taiwan: Chinese Geophys. Soc. Jour., v. 1, no. 2, pp. 215–220, 1949.

Although the geological structure of Taiwan is favorable for oil and gas pools, before the war, more than 200 wells had been drilled on the island with only moderate success. An extended gravitational survey with more than

7,000 stations occupied was made in the western plain of Taiwan in 1946 in search of oil. Several promising locations were discovered.

In the Chin-Shui [Kinsui] gas field, where important gas sand deposits had been discovered at a depth of 600–700 meters, Bouguer anomalies of as much as 5 mgal. were found. Most of the producing wells lie closely to the gravity maximum. The gravitational data indicate a structural high at a greater depth than the known deposit of gas sand.

In the Chu-Tung [Chikutō] gas field, the map of gravity anomalies suggests the structure is a symmetrical anticline with the axis striking east-northeast and with two culminations separated by a saddle.

A third important anticline is the Tung-Shio [Tsūsho] anticline near the coast, partly covered by the alluvial deposits. A map of Bouguer anomalies of this region is also given. On the basis of gravitational data two culminations on the anticline proper can be expected.—*S. T. V.*

MAGNETIC METHODS

12248. de Andrade, Adalberto, Martins da Silva, João, Dos Reis Arrude, Carlos, and da Silva Gamerio, José. Minas de ferro de Montemór-o-Novo [Iron mines of Montemór-o-Novo]: Portugal Servico de fomento mineiro Relatoria, no. 15, 125 pp., 1949.

Magnetic surveys were made by the Aktiebologet Elektrisk Malmletning of Stockholm in connection with the exploitation of the iron ores south of Montemór-o-Novo. In general a good agreement was found between the results of the survey and the subsequent drilling. The total amount of deposits discovered to date is about 150,000 tons.—*S. T. V.*

12249. de Andrade, Adalberto. Breve noticia sobre a aplicacao do processo magnetico de prospeccao en algums dos jazigos de magnetite do Alentejo [Short notes on the use of the magnetic method in prospecting for magnetite ores in Alentejo]: Portugal Servico de fomento mineiro, Estudos, notas, e trabalhas, v. 5, no. 1–2, pp. 1–22, 1949.

This is a report on magnetic surveys in different parts of Alto Alentejo in search for magnetite ores, especially the exploration of the Montemór-o-Novo and Alvito deposits. The first survey was partly reported in the preceding abstract. A total of 9,190 stations in an area of 16.78 sq. km. were occupied during these surveys. The results are presented in the form of fifteen magnetic profiles, two maps of magnetic isoanomalies, and numerous cross sections.—*S. T. V.*

12250. Modriniak, N. Geophysical investigation of Rotorua: New Zealand Jour. Sci. Technology, v. 30, no. 1, pp. 1–19, 1948 (1949).

The magnetic properties of an area of approximately 16 sq. mi. northeast of the lake, Roto Rua, were investigated and the data analyzed for information of geological structures controlling the Roto Rua depression. The general trend of isoanomaly lines is believed to be the expression of an extensive sheet of northerly strike and westerly dip, probably produced by sinking of part of the ignimbrite sheet. Roto Rua occupies a drowned downwarp. The existence of a fault between Whakarewarewa and Ohinemutu [Roto Rua] is inferred and the extension of the sinuous Horohoro fault northward suggested. Experimental resistivity and spontaneous polarization measurements indicated valuable results might be obtained from more extensive observations.—*M. C. R.*

12251. Schonstedt, E. O. and Irons, H. R. Airborne magnetometer for measuring the earth's magnetic vector: Science, v. 110, no. 2858, pp. 377–378, 1949.

An airborne instrument that continuously records geomagnetic information from which all magnetic components may be determined has been developed by the Naval Ordnance Laboratory. The instrument measures the intensity and direction of total magnetic field vector with respect to a set of coordinate axes stabilized with respect to the surface of the earth. At present operation of the magnetometer is limited to areas of dip angles greater than about 50°, but additional developments now in progress may extend the range of operation.—*M. C. R.*

12252. Hurley, P. M., and Thompson, J. B. Airborne magnetometer and geological reconnaissance survey in northwestern Maine: Geol. Soc. America Bull., v. 61, no. 8, pp. 835–842, 1950.

An aeromagnetic survey of about 2,000 square miles in northwestern Maine was made to guide and assist reconnaissance geologic mapping of asbestos-bearing ultramafic rocks. Diagnostic magnetic patterns were found to be associated with the four principal geologic units: broad low gradient features over the Moose River sandstone, slate, and quartzite of middle Devonian age; linear anomalies over the slates, pyroclastics, flows, and ultramafic intrusives of Silurian and Devonian age; "bird's eye maple" over granites of late Devonian and pre-Silurian age; and "intricate and continuing convolutions" over areas of "older" gneiss. The report describes the geologic formations, in particular the Moose River, and is accompanied by a geologic map with fossil localities and superimposed magnetic total-intensity contours.—*J. R. B.*

12253. U. S. Geological Survey. Total intensity aeromagnetic maps of Indiana: Geophysical Investigations Maps GP20–GP34, Scale 1 inch=1 mile, contour interval=10 gammas, 1950.

A continuation of the series first listed in Abstract 11816. Maps of Adams, Allen, Carroll, De Kalb, Howard, Huntington, Kosciusko, Lagrange, Miami, Noble, Porter, Steuben, Wabash, Wells, and Whitley Counties, an area of 6,000 square miles in northern Indiana, have been prepared by W. J. Dempsey, J. R. Henderson, and R. T. Duffner.—*M. C. R.*

12254. U. S. Geological Survey. Total intensity aeromagnetic maps of Missouri. Geophysical Investigations Maps GP13 and GP14, Scale 2 inches=1 mile, contour interval=50 gammas, 1950.

A continuation of the series first listed in Geophys. Abstract 11818. Maps of Potosi and Bonne Terre quadrangles, an area of 500 square miles in the southeast Missouri lead district, have been prepared by W. J. Dempsey, R. T. Duffner, J. H. Henderson, and Fred Keller.—*M. C. R.*

12255. Gilmour, Andrew. The state of seismic prospecting: Geophysics, v. 15, no. 3, pp. 395–408, 1950 and Am. Assoc. Petroleum Geologists Bull., v. 34, no. 7, pp. 1384–1388, 1950.

This is the address of the retiring president of the Society of Exploration Geophysicists. The development of seismic prospecting is reviewed, and a plea is made for more adequately trained personnel so that the method may continue to advance.—*M. C. R.*

SEISMIC METHODS

12256. Nesbit R. H. The work of the geologist in civil engineering: Ohio State Univ., Eng. Exper. Sta. News, v. 22, no. 2, pp. 4–8, 23–25, 1950.

A brief review of the working relations between geologist and civil engineer is presented, with special emphasis on problems that arise in connection with dam construction where the shallow-refraction seismic method may be used. Several geologic cross sections with corresponding seismic profiles are included.—*S. T. V.*

12257. Lorenz, Hans. Stand des dynamischen Bodenuntersuchungsverfahrens [The present status of the dynamic ground exploration]: Abh. Bodenmechanik u. Grundbau 1939–1948, pp. 81–87, 1949.

The dynamic investigation of the ground for structural purposes consists of producing seismic waves in it by a special vibrator and studying their propagation in different directions. Observations of the time curve by geophones placed at varying distances from the point of the generation of the waves may provide reliable information on the geologic structure of the site.

A description of the vibrator for producing impulses in varying directions is given. A method is also described for placing the vibrator in a vertical drill hole at different depths and observing the produced seismic waves by a geophone placed in another hole.—*S. T. V.*

12258. Carome, E. F. An electronic vibration meter: Am. Geophys. Union Trans., v. 31, no. 4, pp. 529–530, 1950.

A completely portable electronic instrument for vibration measurement has been developed. The instrument is basically a pulse voltmeter and as such can be used with different types of transducers to measure peak displacement, velocity, or acceleration. As an accelerometer, it consists of three parts: an inertia-type pickup, an amplifier, and a pulse-recording circuit. The circuit is such that a meter responds to the maximum amplitude of a transient or continuous voltage input. This indication can be held for an indefinite time. The instrument has been used successfully for determining acceleration of vibrations caused by industrial machinery and blasting.—*M. C. R.*

12259. Buchheim, Wilhelm. Zum Problem der elektrischen Übertragung seismischer impulse über grossere Entfernungen mittels Kabel [The problem of electrical transmission of seismic impulses over great distances by cable]: Geofis. Pura e Appl., v. 16, fasc. 1–2, pp. 81–86, 1950.

The possible retardation of the recording and the distortion of the wave shape by the electrical transmission of seismic waves from remote seismometers to a central recording panel is studied, using the differential equation for an electrical wave spreading over a cable. The following four arrangements of the connecting wires are considered: an overhead line consisting of a double conductor with two millimeters between the wires; the same wires, 1 meter apart; a double conductor laid directly on the ground; a simple wire laid on the ground with the earth used as return line. In each case, the distance between the seismometer and the central recording panel is assumed to be 20 km., and frequencies of different waves assumed to range from 10 to 100 c.p.s. Phase velocities, damping constants, retardation intervals, and the percentage factors of wave distortion were computed. The damping constants can be as high as one percent per kilometer length of the cable, and retardation of the record in the conditions investigated may be about 1/150 second producing a noticeable distortion of the wave shape.—*S. T. V.*

12260. Berson, I. S. Interpretation of travel time curves of Mintrop's waves for a refracting boundary of arbitrary shape [in Russian]: Akad. Nauk SSSR Izv., Ser. geog. i geofiz., v. 13, no. 6, pp. 545–555, 1949.

The problem considered is the determination of the refracting boundary surface between two formations from a given three dimensional travel time curve of Mintrop's waves, when the velocity V_1 in the overburden is known as well as the velocity V_2 in every point of the refracting boundary. The travel time curve is referred to a chosen line *S* passing through the initial points. This determines uniquely the shape of the refracting boundary. A method is developed of finding from this given line, the corresponding curve *L* on the boundary surface. The line *L* may also be found from the travel time curve of the reflected waves.

The procedure for determining the refracting boundary may be made relatively simple if tangential planes touching the boundary at a series of consecutive points are first determined. Analytically the problem is reduced to the integration of a system of ordinary differential equations of the first order. The integration may be made either by the approximate method of Sterner or Euler's procedure. The initial conditions vary from point to point of line *L*. The values of functions entering into these equations can be found either by numerical computations or graphically. The integral determines a family of characteristics, passing through every chosen point of line *L*. The envelope of these characteristics forms the boundary surface.

Any desired degree of precision can be achieved. For the limiting case with Δz 0 the most accurate solution is obtained. In practice, there is no good reason to strive for a high degree of accuracy because variations of the velocities V_1 and V_2 are known only approximately.

The same method may be used in interpreting a series of travel time curves for a stratified medium if the velocities in individual layers are given as well as the velocities along the boundary surface between the layers.—*S. T. V.*

12261. Krey, Theodore. Die Berucksichtigung der Brechung in der Reflexionsseismik [Influence of refraction phenomena in seismic prospecting by the reflection method]: Erdöl u. Kohle, 2d Jahrg., Heft 7, pp. 273–277, 1949.

In interpreting observations made by seismic reflection method, the refraction of seismic rays is generally neglected and the rays are assumed rectilinear. Such simplification is frequently inadmissible and results in an inaccurate or even erroneous location of the reflecting horizon. An approximate method is presented, taking into account the refraction of seismic rays. Corrections are given (but not derived) for the angle of the arrival of reflected rays and for the coordinates of the base of the perpendicular to the reflecting horizon from the shot point. The iteration procedure is recommended as giving good results even in difficult geological conditions. Several examples illustrate the suggested procedure.—*S. T. V.*

12262. Quarles, Milton, Jr. Fault interpretation from seismic data in southwest Texas: Geophysics, v. 15, no. 3, pp. 462–476, 1950.

Many of the oil-bearing structures around the Gulf Coast and in southwest Texas are found along normal faults which are characterized by the shallow dip of fault planes, "reverse-drag" appearance of dips on each side of the fault, and the rapid dying out of movement both vertically and horizontally. Reflection shooting across these faults gives normal information on the downthrown side but produces distorted and misleading data below the fault plane on the upthrown side. In one type of distortion, as the fault is approached on the upthrown side, the first distorted profiles under the fault have recognizable reflections with a lag of several feet, as much as 100 milliseconds, from the same reflections on the adjacent normal profile. This "drop" type of distortion is explained by a refraction pattern downward along a portion of the fault plane before the energy is reflected back from the recognized interface. If this time lag is not recognized, the fault may be located as much as a mile from its true position.

In the second type of distortion, the deeper beds appear to dip down at a steeper than normal angle toward the fault plane. Distortion of this kind appears to be associated with faults with throws of 50 to 300 feet. This "increased-dip" type of distortion may be explained either as a reflection time lag through the gouge zone of the fault or a refraction across the fault plane and a reflection from the known interface. The magnitude of this effect may be great enough to cause some reflecting horizons on the upthrown side of the fault to be plotted deeper than those on the downthrown side. It can easily cause errors in locating the fault and determining the magnitude and direction of throw, or may cause the fault to be completely missed.—*M. C. R.*

12263. Lorenz, Hans. Anwendung des seismischen Bodenuntersuchungsverfahrens bei einem Talsperrenbau [The use of the seismic exploration method during dam construction]: Bautechnik-Archiv, Heft 3, pp. 40–48, 1949.

Before the construction of the Bicaz dam across the Bystřice in the eastern Carpathian Mountains, an extensive seismic refraction survey was made. The article contains a brief review of the method and a description of the apparatus used (such as electric seismographs, oscillograph, recording attachment), and includes a table of the velocities of propagation of seismic waves in different formations in the surveyed area. The underlying formation is a thick layer of sandstone covered with conglomerate of varying thickness, but not less than 10 meters. Approximately 105 determinations were made, some at points in the river bed. The results of seismic surveying were checked by six exploratory drill holes, and excellent agreement between these data was found.—*S. T. V.*

12264. Cantos Figuerola, José. Comprobación por sondeo mecánico de una prospección sismica en Miajadas [Confirmation by exploratory drilling of seismic prospecting results in Miajadas]: Rev. Geofís., v. 9, no. 33, pp. 79–87, 1950.

During the spring of 1947 a seismic refraction survey was made in the environs of Miajadas, Spain, in search for water resources. Thirty profiles of a total length of 25 km., with 358 geophone locations, were obtained. The depth of water-impermeable horizon (granite) was evaluated in 15 profiles. By drilling on two profiles which presented more favorable indications for water reservoirs, the depth to granite was found to be 216 and 150 meters where the seismic determinations had been 208 and 168 meters. These differences may be decreased in future surveys by the changes in the assumptions as to the velocity of wave propagation in the ground.—*S. T. V.*

12265. Müller-Deile, G. Reflexions seismische Messungen im Wattenmeer bei Cuxhaven [Seismic reflection measurements on the sandbanks near Cuxhaven]: Erdöl u. Kohle, Jahrg. 3, Heft 5, pp. 214–216, 1950.

A short description is given of seismic work over sandbanks between Cuxhaven and Spieka on the North Sea in a region regularly covered with water during high tide. Only a short interval of time during the ebb was available for the measurements. Results of the seismic surveying are compared with the data obtained from seven exploratory drillings. Two profiles to depths of more than 2,000 meters show the geological interpretation.—*S. T. V.*

12266. Ramspeck, Adolf, and Schulze, G. A. Schwingungsuntersuchungen an einfachen Mauerwerkskorpern und Gebauden [Vibration studies on simple masonry bodies and buildings]: Bautechnik-Archiv, Heft 3, pp. 66–72, 1949.

Several pieces of masonry walls of different dimensions and composition were tested to determine the critical frequencies if exposed to seismic vibrations. Vibrations of the ground were produced by a mechanical vibrator, running with different speeds, set on the ground at a certain distance from test specimens, and vibrations of these specimens were measured by seismometers. A sharp change of the amplitudes was observed at a certain frequency characteristic for the dimensions and mechanical properties of individual specimens. In another series of experiments vibrations of the ground were again produced by a vibrator and the resulting vibrations were observed and measured at different heights in a three-story building nearby. By running the vibrator with different speeds, it was possible to determine the critical frequency of the building. Knowledge of critical frequency of a structure is of great importance in evaluating the seismic danger to which it would be exposed at the time of an earthquake.—*S. T. V.*

ELECTRICAL METHODS

12267. Fritsch, Volker. Grundzüge der angewandten Geoelektrik [Principles of the electrical methods in applied geophysics], Vienna, Manzche Verlags u. Univ. Buchhandlung, 412 pp., 1949.

This is a treatise on the electrical methods and procedures in applied geophysics. Among the subjects discussed are the electrical properties of rocks and aggregates, measurements by methods using direct current, and alternating current of low and moderate frequency, and also high-frequency-radio methods. Practical examples of investigations of geological structures,. of prospecting methods in hydrological work, geophysical exploration of the ground for foundations of structures, exploration of ore deposits, prospecting for oil, and for potassium are described. An extended bibliography is included.—*S. T. V.*

12268. Paul, Bernt. Geoelektrische Schlumberger Messungen an der Erdoberfläche und in Bohrloch [Geoelectrical measurements by the Schlumberger method on the surface of the ground and in drill holes]: Erdöl und Tektonik in Nordwestdeutschland, pp. 302–307, 1949.

Most commonly used electrical exploration methods are the four or five point-resistivity measurements and self-potential determinations. With the exception of a few ores, dry rocks are practically nonconductive, and only their water content makes them conductors. Differences in mineral substances dissolved in this water, and variations in porosity, surrounding temperature and other factors cause variation of measured electrical resistivity of the same rock, making electrical resistivity a doubtful indicator in prospecting. Only by combining resistivity data with other geophysical and geological information is it possible to interpret the findings of an electrical survey.

Examples of practical cases of prospecting by two electrical procedures and interpretation of the results are discussed. The curve of resistivity variation over a salt dome is also discussed, and a profile obtained from measurements of earth currents is compared with one from a seismic reflection survey.—*S. T. V.*

12269. Gilchrist, Lachlan, Clark, A. R., and Bernholtz, Ben. Methods of determination of the average resistivity of a two-layered medium: Canadian Min. Jour., v. 71, no. 1, pp. 55–64, 1950.

Geoelectric methods used for the location of anomalies in a homogeneous medium are reviewed. The proper experimental procedures are outlined with emphasis placed on equality of stake resistances at the current electrodes. It is pointed out that unequal stake resistances give rise to spurious effects which may mask the true anomalies. To avoid this a field method is presented for the measurement and equalization of stake resistances. The formulas and some of the methods used in interpreting are discussed for both point and line electrodes placed either within or on the surface of the earth. Several illustrations are given showing the applicability and usefulness of the various methods.—*I. Z.*

12270. Enenstein, B. S. Results of field experiments on the building up of the electrical field in the ground [in Russian]: Akad. Nauk SSSR, Doklady, v. 67, no. 1, pp. 57–59, 1949.

The process of building up of the electrical field in the ground under the action of an electrical impulse has been investigated experimentally with special attention to the period of transient conditions. An impulse of rectangular wave shape, produced by a thyratron generator, was sent through a feeding dipole into the ground and the potential difference produced by the impulse was measured at different distances from the feeder by a cathode-ray oscillograph provided with photographic recording attachment. Good agreement was found between measured values and those computed from Tikhonov's formula $t=\pi x^2/10^9 r$, where t=time necessary for the field intensity at a point x meters distant from the dipole to reach 0.78 of its final value, and r is the specific electric resistance of the ground. Differences in the experimental determination caused by atmospheric phenomena, radio interference, and other causes were overcome by a complicated arrangement not described in this paper.—*S. T. V.*

12271. Tikhonov, A. N. On the transient of an electric pulse in an unhomogeneous stratified semispace [in Russian]: Acad. Nauk SSSR Izv., Ser. geog. i geofiz., v. 14, no. 3, pp. 199–222, 1950.

The previous study of the transient of an electrical pulse in a homogeneous conductive semispace (*see* Geophys. Abstract 9235) is extended to the case of unhomogeneous stratified semispace. It is assumed that a cable, grounded at both ends, is laid on the surface of a conductive semispace (earth), and at a certain moment electric current of an intensity $I\ (t)$, variable with time, is switched into the cable, the initial value of the current being given. The process of the distribution of the current in different points of space, varying with time is studied, especially during the transient period.

The method of solution consists in determination of the electric and magnetic vectors, satisfying Maxwell equations under the conditions of the problem. The magnetic field has the property that the circulation around the current line over an infinitesimal contour is determined by the expression $(4\pi/C)I$ where C indicates the use of electronic units. Electric conductivity varies from one layer to the next, but remains constant within the layer.

The solution is given in a general form, numerical results corresponding to different specific cases are to be published later.—*S. T. V.*

12272. Buchheim, Wilhelm. Über ein neuartiges Prinzip der elektrischen Tiefensondierung [A new principle of electrical deep sounding]: Geofis. Pura e Appl., v. 16, fasc. 1–2, pp. 76–80, 1950.

A new method of electrical exploration, based on the theoretical studies of R. M. Foster and S. S. Stefanescu, may be especially useful in deep sounding or in exploration of stratified ground. In the proposed procedure a constant separation of the current and potential electrodes is used and the frequency of the feeding current is varied. It is possible with a 1,000-meter spread of the electrodes to study strata as deep as about 500 meters. A great saving of time is effected by elimination of the fastidious job of electrode grounding and the effects of polarization do not interfere with the measurements. However, a technical difficulty exists in the necessity of varying the frequency from a few cycles per second to 500 or even 2,400 according to the depth to be reached.—*S. T. V.*

12273. Crumrine, K. C. A method of electrical profiling: Geophysics, v. 15, no. 3, pp. 477–482, 1950.

The mutual resistances pertaining to 22 electrode patterns may be obtained by making three sets of measurements at each station, using three patterns with fixed electrode spacing along the profiles. "Mutual resistance" is defined as the ratio of the potential difference between the two potential electrodes to the energizing current, when direct current or low-frequency alternating current is used. The 22 electrode patterns and their corresponding apparent resistivity equations are tabulated, together with equations for mutual resistances for 19 electrode patterns, expressed in terms of the three observed mutual resistances.—*H. R. J.*

12274. Müller, Max. Die Drehkreuzmethode [The method of rotating electrodes placed crosswise.]: Geofis. Pura e Appl., v. 16, fasc. 1–2, pp. 47–75, 1950.

Continuous current is sent into the ground through two feeding electrodes and the generated field is measured on the surface of the earth by two potential electrodes, placed either on a line perpendicular to the line of feeding electrodes or at a certain angle to it. The distance from the midpoint to the symmetrically placed measuring electrodes may be varied. The pattern of the electrical field generated in a homogeneous ground by the feeding electrodes is known, and that for spherical and ellipsoidal disturbing bodies in different positions underground with reference to the feeding electrodes is computed.

By comparing the master charts with the results obtained from a survey of a region, the position of the disturbing bodies may be determined approximately.

With certain modifications the new arrangement can be used as induction method with two coils perpendicular to one another, supplied by low-frequency current.—*S. T. V.*

12275. Maher, J. C., and Jones, P. H. Ground-water exploration in the Natchitoches area, Louisiana: U. S. Geol. Survey Water-Supply Paper 968–D, pp. 159–211, 1949.

As part of an exploratory program to locate an adequate water supply for the city of Natchitoches, La., electric logs were made of nine exploratory wells which penetrated the Sparta sands and the water sand of the Wilcox formation. These consisted of both self-potential and apparent-resistivity curves, the latter obtained for different electrode spacings. Fresh-water sands were indicated by sharp deflections of the resistivity curves to the right and more moderate deflections of the self-potential curve either to the left or to the right, away from the shale base. A detailed geological description of the area is included.—*S. T. V.*

12276. Bureau des Recherches géologiques et géophysiques. Prospection électrotellurique de la Bresse et du Bas-Dauphiné Pub. 5, 47 pp. 1948.

Detailed descriptions are given of the electrotelluric survey in Bresse and Bas-Dauphiné. The surveys in Bas-Dauphiné were among the first by the telluric method, and the experience gained in Bas-Dauphiné and Bresse has contributed greatly to the methods. In addition, a number of soundings along short profiles were made in known territory to determine the characteristic resistivities as an aid in the geological interpretation. Three maps of northern and southern Bresse and of Bas-Dauphiné show by various colors the intensities of the telluric current.—*M. C. R.*

12277. Goguel, Jean. Essai d'interprétation de la prospection géophysique de la Bresse et du Bas-Dauphiné: Bur. Recherches géol. et géophys. Pub. 6, 79 pp., 1948.

A rather detailed geologic interpretation of the gravimetric and electrical surveys in Bresse and Bas-Dauphiné is made, and from this conclusions are drawn about the relations of the Alps and Jura Mountains. The principal conclusions were reported in Geophys. Abstract 11355.—*M. C. R.*

RADIOACTIVE METHODS

12278. Pringle, R. W. A portable scintillation spectrometer: Atomics, v. 1, pp. 49–50, 1950.

The construction and operation of a portable scintillation spectrometer which may attain a sensitivity of 10^{-10} r./sec. is described. The instrument uses single, activated alkali halide crystals in conjunction with an RCA 5809 wide-angle photomultiplier tube.—*M. C. R.*

12279. Bateman, J. D. Prospecting with the Geiger counter: Canadian Inst. Min. Metallurgy Trans., v. 72, pp. 111–116, 1949.

The Geiger-Müller counter and its use in prospecting for radioactive ores is described. Field experience has shown that 1 to 2 feet of solid rock, 3 to 5 feet of unweathered compact overburden, or a somewhat greater depth of loose soil may effectively shield even important pitchblende occurrences from detection with the counter. As the intensity of the emanations varies inversely as the square of the distance from the source, deposits may remain undetected by the portable counter at distances of 30 to 40 feet. Counter tubes for which the normal cosmic ray background count is of the order 30 to 40 impulses per minute are most satisfactory for counting by earphone.—*S. T. V.*

12280. Goldin, A. S., Rohrer, E. R., and Maclen, R. L. Scintillation type alpha-particle detector: Rev. Sci. Instruments, v. 21, no 6, pp. 554–557, 1950.

A portable scintillation detector for alpha-survey work, specially designed for low-intensity measurements, may be adapted for field use. The instrument can detect as few as 16 alpha counts (32 disintegrations) per minute, being practically free of spurious background; its upper limit is over 48,000 counts per minute and can be raised still higher. The instrument is strong and is unaffected by most atmospheric conditions other than strong sunlight. Gamma radiation up to 14,000 milliroentgens per hour does not give detectable response on this alpha meter. A description of the instrument and a wiring diagram are given—*S. T. V.*

12281. Stead, F. W. Equipment for uranium prospecting: Electrical Eng., v. 69, no. 3, p. 254, 1950.

Equipment and methods of uranium prospecting now in use by the U. S. Geological Survey are described. Included are surface prospecting with portable Geiger counters, subsurface prospecting by gamma-ray logging of exploratory drill holes, and airborne prospecting, using anticoincidence counting-rate meters and air-conductivity meters to detect radiation.—*S. T. V.*

12282. Stead, F. W. Airborne radioactivity surveying speeds uranium prospecting: Eng. and Min. Jour., v. 151, no. 9, pp. 74–77, 1950.

U. S. Geological Survey equipment and techniques of radioactivity surveying are described. Instruments consist of a radiation detector of 19 Geiger counters connected to an anticoincidence counting-rate meter and an air-conductivity meter. All measurements are made at approximately 500 feet above the ground and flight traverses are spaced at quarter-mile intervals. Anomalies must be defined on a statistical basis, and can be interpreted to mean only that the locality represented is more radioactive than the surrounding area.—*M. C. R.*

WELL LOGGING

12283. Ziloff, Wladimir. Établissement et interprétation des diagrammes d'investigation continue des sondes en vue de leur completement [Obtaining of continuous logs and their interpretation in view of the completion of exploratory drill holes]: Inst. Franç. petrole Rev., v. 4, no. 10, pp. 566–575 and no. 11, pp. 608–614, 1949.

Methods of obtaining continuous information on the nature of formations traversed by a drill hole include examination of the cuttings brought to the surface by circulating mud, preparation of drilling-time logs, and mud analysis. The first gives information on lithological properties. For this purpose the pumped mud is at definite time intervals driven through several containers where the suspended rock particles are caught by the system of screens of different fineness. The drawback is that particles of different size do not arrive at the top of the hole simultaneously but undergo some differentiation. A table of time delay as a function of particle size is given. The particles obtained from the screens are studied for their mineralogical composition and are chemically analyzed for their hydrocarbon content. An apparatus for continuous registration of this content is described. An increase of the hydrocarbons in the cuttings is an indication of the proximity of a producing horizon. An important empirical rule states that the increase of higher homologues, without a simultaneous increase of the methane content, is an indication of a poor reservoir.

The drilling speed is in certain limits inversely proportional to the hardness of the rock and this is in turn a function of its porosity. Parallel microscopic examination of samples will show when a greater softness of the rock is caused by the presence of gypsum or calcite. A table of the speed of drilling as a function of porosity is given, and several instruments for measuring and recording this speed are described.—*S. T. V.*

12284. Doll, H. G. The S. P. log: Theoretical analysis and principles of interpretation: Am. Inst. Min. Met. Eng. Trans., v. 179, pp. 146–186, 1949. (Also issued as TP 2503 in Petroleum Technology, September 1948.)

A theory of the S. P. or spontaneous potential log which may serve as a guide for interpretation and a foundation for future discussion is presented. The log is shown to be a measurement of the potential drop along the drill hole caused by ohmic effect in mud. The e.m.f. generating the S. P. current which affects the S. P. log arise from two types of phenomena: electrokinetic, producing an e.m.f. of filtration at the contact between drilling mud and permeable bed: and electrochemical at the contact of media of different natures. The shape and amplitude of peaks may be influenced by the total e.m.f. involved; the thickness of the bed; resistivity of the bed, surrounding formations, or mud; the diameter of the drill hole; or the depth of penetration of mud filtrate in permeable beds.

The log is essentially a good detector of permeable beds, but it does not measure the value of the permeability or porosity. Several simple rules are given for better distinction of the boundaries of permeable sections.—*M. C. R.*

12285. Roberts, A. Portable Geiger counter for drill holes: Radio Electronic Eng., v. 13, pp. 16–17, 21, 28, 1949.

A portable, battery-powered Geiger-Müller counter mounted on the end of a 1,000-foot cable which can be lowered down in 1¼-inch borehole is described. The tube is a single-ended self-quenching type. The tube signal is amplified 2,500 times in 2 stages.—*M. C. R.*

12286. Bush, R. E. Porosities can be obtained from radioactivity logs in West Texas. Examples of quantitative technique shown for Scurry County: Oil and Gas Jour., v. 48, no. 51, pp. 153–165, 1950.

A radioactivity log may be used to determine porosity in a given area by selecting a cored well which has been logged by radioactivity logging devices as a base well from which a neutron-derived porosity curve and a gamma-ray subtractive curve may be determined. These curves may then be applied, after allowance for log sensitivity, to wells with the same bore-hole diameter and casing program. For wells with a different bore diameter or casing program, other base determinations must be made to satisfy all conditions existing in the field. Several examples are given of quantitative interpretations of radioactivity logs of wells in Scurry County, Tex. A neutron-derived porosity curve is shown which is applicable to the radioactivity logs of other 6¼-inch uncased wells in the area.—*M. C. R.*

12287. Andrée, H. Neues diagramm zur Berechnung der Durchlassigkeit von Speichergesteinen aus Laboratoriumsmessungen [A new diagram for computation of the permeability of reservoir rocks from laboratory measurements]: Erdöl u. Tektonik in Nordwestdeutschland, pp. 314–321, 1949.

Among the tests usually made on lithological samples in well logging, determinations of porosity saturation and in the first line of permeability are the most important. To facilitate the experimental procedure and to eliminate tedious calculations in determinations of permeability following the procedure and standards established in 1935 by the American Petroleum Institute, a graphical method is suggested. The new procedure, with auxiliary tables and four alinement charts, represents a great saving in time. The accuracy of the proposed method is satisfactory for practical purposes, the errors seldom being greater than ±5 percent. The suggested method of permeability computation is applicable to fluid flow of any intensity and under any pressure. Several examples of the use of these charts are worked out.—*S. T. V.*

12288. Schumann, H. Die Raumgestaltung von Gesteinsporen [The spatial variation of the form of pores in rocks]: Erdöl u. Tektonik in Nordwestdeutschland, pp. 321–325, 1949.

The porosity of rocks determines their capacity of retaining water or oil; the form of the pores and their interconnection determines the permeability of formations. Experimental determination of the porosity of a sample is not difficult, but the influence of the form of pores on the permeability is a different and a more complex question. As an example, specimens of glauconite were tested for porosity and permeability, and it was found that test pieces of the same percentage of porosity may show great differences in permeability. In many of the specimens tested, permeability decreased because of the presence of $CaCO_3$ in the mineral in the narrowest cross sections of the pores. The details of the experimental procedure for the determination of the porosity and of the form of the pores are discussed, and also a tentative numerical analysis of these two properties of a mineral.—*S. T. V.*

TECHNICAL AIDS

12289. Honnell, P. M. The application of feedback to an electromechanical transducer for seismograph testing: Seismol. Soc. America Bull., v. 40, no. 3, pp. 217–231, 1950.

Feedback may be used to provide substantially constant amplitude, velocity, or acceleration response from electromechanical transducers for seismograph testing, independent of loading effects. Careful control of residual parameters is needed to prevent undesired sustained oscillations of the platform. Although the improvement in response characteristics results in reduced platform velocities for a given control voltage, this is not serious as the available control voltage from most oscillators is usually ample. For nonsinusoidal wave shapes with abrupt discontinuities, such as square waves, there is no practicable substitute for feedback.—*M. C. R.*

12290. Selenyi, P. Galvanometers with photoelectric feedback: Hungarica Acta physica, v. 1, no. 6, pp. 1–8, 1949.

The functioning of a galvanometer provided with a photoelectric feedback is analyzed and suggestions are made for increasing the sensitivity without simultaneously influencing unfavorably other properties of the apparatus. This can be attained by feeding back currents which are proportional to the first and the second derivatives of the deflection with respect to time. In the differential equation of motion of the galvanometer, these coefficients are respectively the moment of inertia of the moving coil and the moment of damping forces.—*S. T. V.*

12291. Bardeen, Thomas. Crystal shake table for geophone studies: Geophysics, v. 15, no. 3, pp. 456–461, 1950.

Because conventional shake tables are unsuitable for testing geophones, a study was made to determine the possibilities of using piezoelectric crystals as a transducer to convert electrical voltage into mechanical motion. The study showed that a shake table could be built which would be small, give accurate reproduction of voltage for motions as small as 10^{-8} inches, require very little power, and be simple to calibrate. Construction of such a shake table using ammonium-dihydrogen phosphate as the piezoelectric material is described. The theory of geophone motion shows that measurements of the phase shift between the geophone output and the crystal shake table driving voltage can be used to determine the natural frequency and damping of the moving mass of the geophone.—*M. C. R.*

PATENTS

GRAVITY METHODS

12292. Gravimeter. Reginald C. Sweet, Houston, Tex., assignor to North American Geophysical Co., Houston, Tex., a corporation of Texas: U. S. patent 2,523,075, issued Sept. 19, 1950.

In a gravimeter a gravity-responsive member and an elastic system supporting said member in equilibrium with gravity in such manner as to provide for rotation of the member about a floating horizontal axis, said elastic system being connected to said gravity-responsive member so as to exert a force thereon having both vertical and horizontal components, means for shifting substantially vertically the position of the axis of rotation of the gravity-responsive member a determinable amount to null the instrument said means having a part readily available exteriorly of the gravimeter to facilitate nulling of the instrument. Claims allowed, 10.

MAGNETIC METHODS

12293. Method and apparatus for measuring magnetic fields. Ralph D. Wyckoff, Pittsburgh, Pa., assignor to Gulf Research & Development Co., Pittsburgh, Pa., a corporation of Delaware: U. S. patent 2,518,513, issued Aug. 15, 1950.

In a magnetometer comprising a supporting frame with outer and inner gimbals in which is mounted a gyro and three mutually perpendicular magnetic-detecting elements fixed with respect to the gyro, means controlled by two of the magnetic-detecting elements to precess the gyro into a plane having a fixed relation with respect to the earth's magnetic field, and means for indicating the output of the third magnetic-detecting element; the improvement which comprises a partial spherical shell having a rough outer surface and fixed with respect to the gyro axis so that a diameter of said shell lies on the inner gimbal axis, a pair of oppositely directed air jets on said supporting frame whose air impinges on said shell to respectively generate oppositely directed torques about the inner gimbal axis, an impeller mounted on the outer gimbal axis, a pair of oppositely directed air jets on said supporting frame whose air impinges on said impeller to respectively generate oppositely directed torques about the outer gimbal axis, and electrically actuated valves controlled by the said two precession-controlling magnetic-detecting elements to respectively control the air flowing through said jets to cause precession of the gyro into the desired orientation. Claims allowed, 4.

12294. Apparatus for detecting magnetic disturbances. Theodore Zuschlag, West Englewood, N. J., assignor by mesne assignments, to Lundberg Explorations Ltd., Toronto, Ontario, Canada, a corporation of Ontario: U. S. patent 2,519,094, issued Aug. 15, 1950.

Apparatus of the character described comprising, a plurality of spaced rotatable coils, means for rotating the coils in unison, transformers having their primaries connected to the coils and mounted to rotate therewith, stationary secondaries for said transformers connected in series opposition, a potentiometer, a variometer connected with the potentiometer, means for connecting the outputs of the transformer secondaries to the potentiometer and variometer, an amplifier, means for connecting the potentiometer and the variometer to the amplifier, and means for detecting any differential in the said amplified outputs. Claims allowed, 3.

12295. Magnetic gradient measurement. Robert E. Fearon, Tulsa, Okla., assignor to Stanolind Oil and Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,520,677, issued Aug. 29, 1950.

The method of measuring the gradient of a magnetic field which comprises disposing at a first spacing in said field a pair of substantially identical, magnetizable, ferromagnetic members, simultaneously and equally exposing each of said members to alternating magnetizing forces of two different unrelated frequencies, deriving from the resultant flux in each of said members electric waves containing sum and difference modulation frequencies of said two frequencies, subtracting from said electric waves produced at one of said members the corresponding electric waves produced at the other of said members, producing a first indication of the amplitude of the difference of said waves of one of said modulation frequencies, repeating the foregoing steps at a second spacing of said members whereby a second indication is produced, and determining the quotient of the difference between said first and said second indications by the difference between said first and second spacings. Claims allowed, 13.

SEISMIC METHODS

12296. Seismic exploration by means of periodic excitation. Serge A. Scherbatskoy, Tulsa, Okla., U. S. patent 2,521,130, issued Sept. 5, 1950.

Method of subsurface seismic surveying which comprises generating a periodic disturbance in the earth and varying the frequency of said disturbance in accordance with a predetermined function, receiving the resultant seismic waves travelling through the earth at a point removed from the source of said disturbance, transforming said received seismic waves into corresponding electrical currents, selectively receiving said currents and varying the selectivity of said reception simultaneously with the variation of the frequency of said disturbance, the variation of selectivity of said reception being effected in accordance with said predetermined function, and recording said selectivity received waves. Claims allowed, 8.

12297. Seismic wave transmitter. Robert S. Dahlberg, Jr., Caracas, Venezuela, assignor to Standard Oil Development Co., a corporation of Delaware: U. S. patent 2,522,433, issued Sept. 12, 1950.

Improved apparatus for introducing seismic energy into the earth at a selected point adjacent a fluid-filled borehole, comprising a cylindrical magnet provided with a central bore and an annular channel, a driving rod positioned longitudinally within said central bore, a coil positioned within said annular channel and provided with means mechanically connecting said coil with said driving rod, a mass element attached to said driving rod, flexible diaphragms attached to said rod and fastened to each end of said magnet in a manner providing for alignment of said driving rod within said central bore, said diaphragms defining with said central bore and said annular channel an oil-tight chamber, a reservoir for oil positioned adjacent the magnet and communicating with said chamber, and means associated with said reservoir adapted to maintain a pressure balance between oil placed in said reservoir and fluid in said borehole. Claims allowed, 3.

ELECTRICAL METHODS

12298. Einrichtung zur geophysikalischen Erforschung [Arrangement for geophysical exploration]. H. T. F. Lundberg, Toronto, Canada, and Theodore Zuschlag, West Englewood, U. S. A.: Austrian patent 166,400, issued July 25, 1950.

The invention relates to an arrangement for geophysical exploration, consisting of one or several electrical or magnetic sounding instruments which during the motion or when standing still could indicate the presence of anomalies in the ground, attributable to deposits of ores or petroleum. The arrangement is carried on a movable carrier, preferably an aircraft or a vessel, adapted also for transport of the attendants and equipment with a suspension for the instruments serving for stabilization of these instruments notwithstanding the movements of the movable carrier. Recording attachments are also installed on the carrier, acted upon by the sounding instrument or several of them and registering the action of the detected anomalies. Claims allowed, 9.—*S. T. V.*

RADIOACTIVE METHODS

12299. Radioactivity detector. Gilbert J. Perlow, John D. Shipman, Jr., and Clarence A. Schroeder, Washington, D. C.: U. S. patent 2,513,356, issued July 4, 1950.

A gamma-radiation detector, comprising a first radioactive-counter means, a second radioactive-counter means surrounding the first providing no substantial opposition to the passage of gamma-ray energy to the first counter means, and output means connected to the first and second counter means combining in opposition the output signals from said first and second counter means. Claims allowed, 8.

12300. Detecting device. William Rudolph Kanne, Chicago, Ill., assignor to the United States of America as represented by the U. S. Atomic Energy Comm.: U. S. patent 2,513,805, issued July 4, 1950.

In an instrument for detecting radioactivity, the combination of a plurality of fluorescent screens facing in different directions and at least one absorber associated with the exterior surface of one of said screens and partially shielding the screen with which it is associated. Claims allowed, 5.

12301. Radiation detector. Hugh G. Neil, Knoxville, Tenn., assignor, by mesne assignments, to the United States of America as represented by the U. S. Atomic Energy Comm.: U. S. patent 2,514,135, issued July 4, 1950.

A system of the character described for detecting radiation comprising means responsive to the radiation for producing electrical impulses corresponding in magnitude and configuration to the radiation, a circuit fed by the radiation responsive means for producing signals which discriminate in favor of the higher frequencies, means for amplifying and reproducing the signals, and an attenuator responsive to the signals for offering progressively greater attenuation to the lower frequencies. Claims allowed, 11.

12302. Radiation measurement and instrument testing. Jacob Neufeld, Oak Ridge, Tenn.: U. S. patent 2,516,334, issued July 25, 1950.

In an arrangement for testing the performance of a radiation counter by exposing said counter to a stream of radiation particles emitted at random, said counter translating the incoming particles into current impulses, an electrical network connected to said counter for producing a fluctuating current representing at any instant the rate of occurrence of said impulses, another network responsive to the output of said first network for producing a signal related to all the values of said current within a selected time interval, and a means jointly responsive to the outputs of said two networks for producing an indication representing a relation between said two outputs. Claims allowed, 8.

12303. Apparatus for measuring radiant energy. Frank G. Brockman, Dobbs Ferry, N. Y., assignor to Socony-Vacuum Oil Co., Inc., a corporation of New York: U. S. patent 2,516,672, issued July 25, 1950.

A bolometer comprising in combination a sealed housing, a metallic filament having uniform physical properties including cross-sectional area and electrical resistance and a substantial temperature coefficient of resistance in said housing, a pair of electrical conductors extending from a point outside the housing into the housing and forming electrical contacts with and supports for the respective ends of the filament, a third electrical conductor extending from a point outside the housing into the housing and forming electrical contact with and a support for the center of said filament, said housing shielding one section of said filament from radiation and having a window adjacent one section of said filament, whereby only one section of the filament can be subjected to radiant energy. Claims allowed, 3.

12304. Scintillation type radiation detector and coincidence circuit therefor. George A. Morton, Princeton, N. J., assignor to Radio Corp. of America, a corporation of Delaware: U. S. patent 2,517,404, issued Aug. 1, 1950.

In an electronic apparatus including a pair of electronic energy-responsive devices, a plurality of nonlinear resistive conductors, a pair of electron amplifiers and a third electronic energy-responsive device, the method of energizing the said third responsive device only when said pair of devices are energized simultaneously comprising: dividing the outputs of said pair of amplifiers, passing one each of said divided outputs through respective nonlinear resistive conductors, combining the others of said divided outputs in opposite polarity to said first-mentioned outputs, and passing the combined other outputs thereof through a third nonlinear resistive conductor, combining the outputs of said conductors into a coincidence output and applying said coincidence output to said third responsive device. Claims allowed, 14.

12305. Method and apparatus for measuring Alpha-particle radiation. Richard W. Dodson, Pasadena, Calif., and William H. Beamer, Youngstown, Ohio, assignors to the United States of America as represented by the U. S. Atomic Energy Comm.: U. S. patent 2,517,469, issued Aug. 1, 1950.

In apparatus of the class described, a gas tight closure which contains a quantity of a gaseous material which will react with alpha particles to provide neutrons, means for supporting an alpha-particle source within said closure, a body of neutron-slowing material disposed about said closure, said body containing a plurality of cavities located at differing distances from said closure, and neutron-detection means disposed within at least some of said cavities. Claims allowed, 6.

12306. Radiation counter. Volney C. Wilson, Schenectady, N. Y., assignor to the United States of America as represented by the U. S. Atomic Energy Comm.: U. S. patent 2,519,007, issued Aug. 15, 1950.

A fast neutron counter comprising spaced electrodes and a plurality of hydrogenous wafers dividing the space between said electrodes into a plurality of ionization regions. Claims allowed, 12.

12307. Method of measuring extent of oil saturation of porous materials. Paul P. Reichertz, Dallas, Tex., assignor, by mesne assignments, to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,520,058, issued Aug. 22, 1950.

In a process for determining the characteristics of a porous material wherein said porous material is impregnated with a plurality of liquid phases one of which phases is a water phase and another of which phases is an oil phase and said water phase and said oil phase are in contact with each other within said porous material, the method of measuring the extent of oil saturation of said porous material which comprises dissolving in said oil prior to impregnation of said porous material di-dodecyl ester, tetrahydro ortho-phthalate of cobalt-60, impregnating said porous material with the resulting oil solution, and thereafter measuring the gamma-ray emission from said porous material as a function of the extent of oil saturation of said porous material. Claims allowed, 11.

12308. Geiger-Müller counter tube. Paul Burg Weisz, Swarthmore, Pa.: U. S. patent 2,519,864, issued Aug. 22, 1950.

A gas mixture for the filling of Geiger-Müller tubes for the purpose of providing such tubes with self-quenching properties with pulse equalization at substantially atmospheric internal gas pressure, consisting of a major and a minor component the former of which comprising at least one of the gases hydrogen, nitrogen, argon, neon, and helium, and the latter of which comprising at least one of the hydrocarbons selected from the group of compounds described by the chemical formulae C_nH_{2n+2} and C_nH_{2n} wherein the carbon number *n* be a number between two and eight inclusively, said hydrocarbon component making up from 0.1 percent to 6 percent, approximately, of the total gas pressure. Claims allowed, 4.

12309. Ionization chamber. Emilio G. Segre, Santa Fe, N. Mex., and Owen Chamberlain, Philadelphia, Pa., assignors to the United States of America as represented by the U. S. Atomic Energy Comm.: U. S. patent 2,521,656, issued Sept. 5, 1950.

An ionization chamber having in combination, a metallic housing sealed from the atmosphere, an hydrogenous material disposed within said housing, said material filling a major portion of the volume therein, an ionizable gas maintained within said housing to fill the volume intermediate said hydrogenous material and said housing, a pair of electrodes mutually spaced within said housing and insulatingly supported from said housing by said hydrogenous material, means preventing the transmission of slow neutrons from a point exteriorly of said chamber to said hydrogenous material comprising protective elements opaque to the transmission of slow neutrons substantially covering said electrodes and the interior of said housing, a substantial portion of said electrodes being exposed to said ionizable gas, and means maintaining said electrodes at a difference of potential. Claims allowed, 4.

12310. Geiger-Müller counter. Morris H. Shamos, New York, N. Y.: U. S. patent 2,522,902, issued Sept. 19, 1950.

A Geiger-Müller counter comprising a cathode, a pair of bushing tubes carried in axial alignment therewith, a plurality of metallic bands deposited on said bushings, selected bands being sealed to said cathode and a selected band being sealed to a grid cap mounted on one of said bushing tubes, a wire assembly carried by said bushings, and means to couple conductors to said grid cap and to said cathode. Claims allowed, 6.

WELL LOGGING

12311. Method and apparatus for producing neutron logs of drill holes. Robert E. Fearon, Jean M. Thayer, and Gilbert Swift, Tulsa, Okla., assignors to Well Surveys, Inc., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,515,500, issued July 18, 1950.

A subsurface neutron-logging instrument that comprises a substantially gamma-ray-free source of neutrons and a detector of gamma radiation utilizing an ionizable medium and spaced from the source of neutrons, substantially all metallic surfaces of said detector that are exposed to the ionizable medium consisting of metals which will not emit heavy ionizing particles when bombarded with neutrons. Claims allowed, 22.

12312. Neutron well logging. Robert E. Fearon, Jean M. Thayer, and Gilbert Swift, Tulsa, Okla., assignors to Well Surveys, Inc., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,515,501, issued July 18, 1950.

A method of making a neutron log of the formations penetrated by a well that comprises determining from known knowledge of the types of formations penetrated by the well a spacing that is of the order of but less than the average range of neutrons in the types of formations penetrated by the well, spacing the neutron source from the gamma-ray detector a distance that is of the order of this average range, and making a neutron log of any sufficiently similar well while maintaining but less than this spaced relationship between the neutron source and detector. Claims allowed, 1.

12313. Neutron well logging. Robert E. Fearon, Jean M. Thayer, and Gilbert Swift, Tulsa, Okla., assignors to Well Survey, Inc., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,515,502, issued July 18, 1950.

Neutron well-logging apparatus which comprises a source of neutrons of the alpha rayer-target type, in which the alpha rayer consists of at least one short half-life member present in a radioactive series and is in secular equilibrium with a parent member of relatively long half-life and all members of the series being substantially gamma-ray free, whereby the alpha-rayer will be maintained substantially free of gamma radiation and maintained at substantially constant alpha-ray-emitting strength for a period of time at least as long as its normal half life, and in which the target material is disposed in neutron-producing relationship with said alpha rayer, means for moving said source of neutrons within a well in proximity to respective formations through which the well extends thereby to bombard said formations with neutrons, a detector associated with said source of neutrons for detecting gamma radiation produced by the action of the neutrons in the respective formations, and means for recording said detected radiation in correlation with well depth. Claims allowed, 4.

12314. Method and apparatus for producing neutron logs of drill holes. Jean M. Thayer, Robert E. Fearon, and Gilbert Swift, Tulsa, Okla., assignors to Well Surveys, Inc., Tulsa, Okla., a corporation of Delaware: U. S. patent 2, 515,534, issued July 18, 1950.

A method of neutron well logging which comprises traversing the formations penetrated by the well with a subsurface instrument containing a gamma-ray-free neutron source and a detector of radiation containing an ionizable medium, maintaining the source and detector spaced from each other in the direction of the axis of the well while traversing the well with the instrument, maintaining carbon disulfide between the neutron source and the formations, bombarding the formations with neutrons passing from the source and through the displacing medium, detecting gamma radiation resulting from neutron processes in the strata substantially uncontaminated with other gamma radiation by subjecting an ionizable medium thereto and measuring the resultant current. Claims allowed, 2.

12315. Method and apparatus for neutron well logging. Jean M. Thayer, Gilbert Swift, and Robert E. Fearon, Tulsa, Okla., assignors to Well Surveys, Inc., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,515,535, issued July 18, 1950.

In a neutron logging detector, containing an ionizable medium, the improvement which consists in surfaces exposed to said ionizable medium constituted of a material which does not emit heavy ionizing particles when bombarded by neutrons. Claims allowed, 12.

12316. Neutron log. Gilbert Swift, Robert E. Fearon, and Jean M. Thayer, Tulsa, Okla., assignors to Well Surveys, Inc., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,515,745, issued July 18, 1950.

A method of neutron logging a drill hole that comprises irradiating the formations penetrated by the drill hole with mixed radiation consisting of neutrons and gamma rays which are emitted by a common source, simultaneously irradiating the formations penetrated by the drill hole with neutron-free gamma radiation of the same intensity and hardness as the gamma radiation emitted by the source of mixed radiation, separately detecting gamma radiation influenced by the mixed radiation and gamma radiation which originated with the neutron-free gamma ray source and was scattered by the formations, subtracting the latter detected radiation from the first detected radiation and recording the result in correlation with depth of the drill hole at which detection occurred. Claims allowed, 9.

12317. Shielding method and apparatus for radioactive borehole logging. Shelley Krasnow, New York, N. Y., assignor to Schlumberger Well Surveying Corp., Houston, Tex., a corporation of Delaware: U. S. patent 2,522,522, issued Sept. 19, 1950.

In an apparatus for measuring radioactivity within a borehole, a measuring system, sensitive to radioactivity, and adapted to be lowered within the borehole, a shield mounted adjacent the said system, so as to be traversed by rays emanating from material within the borehole, the said shield having portions facilitating the entrance of rays originating distant from the said shield, and having other portions restricting the entrance of rays from material close to the said shield. Claims allowed, 17.

12318. Fluid ingress well logging. Daniel Silverman, Tulsa, Okla., assignor to Stanolind Oil and Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,517,603, issued Aug. 8, 1950.

A method of determining the fluid-producing characteristics of formations traversed by a well comprising establishing in said well above said formations an interface between salt water and oil, causing said interface to be lowered in said well by introducing oil into said well above said interface, making a log of the amount of said oil introduced into said well as a function of the depth of said interface, subsequently causing well fluid to enter said well from said formations, locating a detector in said well at only elevations corresponding to a point of inflection on said log, isolating sections of said formations which are permeable, and individually sensing a characteristic of said fluid entering said well within said isolated sections. Claims allowed, 2.

12319. Apparatus for determining the permeability of cores. William L. Morris, Bartlesville, Okla., assignor to Phillips Petroleum Co., a corporation of Delaware: U. S. patent 2,521,079, issued Sept. 5, 1950.

A direct reading permeameter comprising, in combination, a flow-viscosity meter including an inverted frusto-conical tube having a float therein, said tube being calibrated in units of permeability, a core holder, a line for establishing a flow of fluid through said meter into said core holder, and a pressure gage communicating with said line. Claims allowed, 2.

TECHNICAL AIDS

12320. Gravity sensitive variable inductance device. Paul F. Shivers, Edina, Minn., assignor to Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., a corporation of Delaware: U. S. patent 2,515,969, issued July 18, 1950.

A gravity-influences control means comprising in combination, a base adapted to be mounted such as to be subject to inclinations from a normal position about a pair of axes normal to one another and lying in the same plane, a plurality of U-shaped core members secured to said base and arranged in diametrically opposed pairs, said pairs of core members being disposed normal to one another and normal to an axis about which said base is adapted to tilt with each core member spaced equidistantly from a common point, an inductance coil mounted on one leg of each of said core members, pivot means secured to said base at said common point, float means including a magnetic element adapted to pivot on said pivot means and disposed to tilt toward and away from said plurality of core members, and casing means enclosing said float means and said core members secured to said base and containing a liquid which buoys said float means into engagement with said pivot means. Claims allowed, 8.

12321. Vibratory assembly for galvanometers. George R. Morrow, Tulsa, Okla., assignor to Century Geophysical Corp., a corporation of Delaware: U. S. patent 2,519,591, issued Aug. 22, 1950.

A vibratory assembly for galvanometers, comprising, a coil, a pair of suspension elements attachable to opposite ends of the coil, generally U-shaped connector members connecting the ends of said coil to said suspension elements, the ends of said coil being supported between the arms of the respective connector members, and a mirror mounted between the arms of one of said connector members and symmetrically arranged therein with respect to the longitudinal axis of said assembly. Claims allowed, 7.

12322. Galvanometer. Marvin E. Morrow, Tulsa, Okla., assignor to Century Geophysical Corp., a corporation of Delaware: U. S. patent 2,519,689, issued Aug. 22, 1950.

A galvanometer, comprising, a cylindrical barrel, a vibratory element mounted therein, anchoring members connected to opposite ends of said vibratory element for anchoring same to opposite ends of said barrel, one of said anchoring members having a tubular extension enclosing a portion of said vibratory element, and a liquid damping medium contained wholly within said extension. Claims allowed, 9.

12323. Vibration insensitive galvanometer. Henri-Georges Doll, Houston, Tex., assignor to Schlumberger Well Surveying Corp., Houston, Tex., a corporation of Delaware: U. S. patent 2,523,866, issued Sept. 26, 1950.

A galvanometer comprising at least two movable elements having substantially identical dynamic characteristics rotatively mounted on substantially parallel axes adjacent to each other, means for connecting only one of said moving element assemblies to a source of electrical energy, a source-free electrical circuit connected to the other of said movable elements, and mirrors carried by and rotatable with said moving elements for reflecting a beam of light from one mirror to the other and from the latter to a surface, whereby the deflection of the beam of light reflected from said other mirror to the surface will be proportional to electrical energy from said source and independent of spurious externally caused accelerations about axes parallel to the axes of said movable elements. Claims allowed, 5.

12324. Time interval recorder. George W. Barnes, Jr., Clifton Heights, Pa., assignor, by mesne assignments, to Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., a corporation of Delaware: U. S. patent 2,519,537, issued Aug. 22, 1950.

In a recording instrument having a chart upon which a record is to be made and an inked ribbon to make a record on the chart, the combination of, a printing plate, the inked ribbon extending around said printing plate, supply and take-up rolls for said ribbon located adjacent one end of said printing plate, spring means to bias normally said take-up roll in a direction to wind said ribbon thereon and to maintain said ribbon taut, a ratchet on said supply roll, an oscillating plate, a pin on said plate to engage a tooth of said ratchet to prevent said supply roll from rotating, means to bias normally said plate in a position for said pin to engage a ratchet tooth, and cam means engaging with said plate operable upon movement thereof to shift said plate to a position in which said pin is out of engagement with the teeth of said ratchet. Claims allowed, 4.

12325. Electrical instrument. Theodore J. Smulski, Gary, Ind., assignor to Productive Inventions, Inc., a corporation of Indiana: U. S. patent 2,520,897, issued Aug. 29, 1950.

An electrical instrument having a bimetallic member for actuating an indicator, said member having a first portion thereof provided with an electric heating element adapted to be energized in accordance with the condition to be indicated, a second portion operatively connected to said first portion for effecting compensation for distortion of the first portion caused by variations of ambient temperature, and a third portion operatively connected to said first portion to supplement the action to be produced by said heated portion, and a pointer actuated by said member, said third portion being operatively connected to said pointer and arranged to increase in response to ambient temperature rise, the extent of movement of the pointer produced by said first portion in response to a given rise of temperature of the first portion above the ambient temperature thereby to compensate for the increase in heat loss of said heated portion at higher ambient temperatures. Claims allowed, 16.

12326. Electrical instrument. Theodore J. Smulski, Gary, Ind., assignor to Productive Inventions, Inc., a corporation of Indiana: U. S. patent 2,520,898, issued Aug. 29, 1950.

An electrical instrument having heat responsive means for actuating an indicator, said means having a first portion provided with an electric heating element adapted to be energized in accordance with the condition to be indicated, a second heat responsive portion operatively connected with said first portion for effecting compensation for movement of said first portion caused by variations of ambient temperature, and a third heat responsive portion operatively connected with said second portion to supplement the action to be produced by said heated portion, and said third portion being arranged to increase in response to ambient temperature rise, the extent of movement of the indicator produced by the heat responsive portions referred to in response to a given rise of temperature above the ambient temperature thereby to compensate for the increase in heat loss of said heat responsive means at higher ambient temperatures. Claims allowed, 10.

12327. Electrical instrument. Theodore J. Smulski, Gary, Ind., assignor to Productive Inventions, Inc., a corporation of Indiana: U. S. patent 2,520,899, issued Aug. 29, 1950.

An electrical instrument having a bimetallic member for actuating an indicator provided with a connecting part, said member having a first portion provided with an electric heating element adapted to be energized in accordance with the condition to be indicated, a connecting part provided on said first portion, a second portion operatively connected with the first portion for effecting compensation for fluctuation of the first portion caused by variations of ambient temperature, and additional bimetallic means provided with a connecting part, said connecting parts on said member and on said additional bimetallic means being directly connected to the connecting part of said indicator, and one of said parts being arranged to increase in response to ambient temperature rise, the extent of movement of the indicator produced by said first portion in response to a given rise of temperature of the first portion above the ambient temperature thereby to compensate for the increase in heat loss of said heated portion at higher ambient temperatures. Claims allowed, 11.

12328. Locating device. Franklin Offner, Chicago, Ill.: U. S. patent 2,517,702, issued Aug. 8, 1950.

In combination, an infrared radiation sensitive element producing electrical current variations in response to variations in incident radiation, means for cyclically varying the radiation on said element, current translating means connected to said element, switching means synchronous with said radiation varying means connected to output of said translating means, current sensitive means connected to said switching means, and means for adjusting the phase shift of said current translating means to compensate for phase shift in said sensitive element. Claims allowed, 4.

12329. Permeability meter. Harry W. Dietert, Ralph E. Steinmueller, and Carl M. King, Detroit, Mich., assignors, by direct and mesne assignments to Harry W. Dietert Co., Detroit, Mich., a corporation of Michigan: U. S. patent 2,516,188, issued July 25, 1950.

A permeability meter comprising a holder for a specimen of predetermined dimensions, a gas chamber in free communication with one end of said specimen, a member movable in a downward direction for displacing gas from said chamber and through the specimen, electrically operated timing mechanism including an electric circuit having a normally open switch and a normally closed switch therein, a vertically movable element of predetermined weight supported by the gas displacement member for movement downward therewith but free therefrom, a yieldably supported member in the path of said element adapted to be depressed by the weight thereof, to close said normally open switch, a second member yieldably supported with greater resistance in the path of said first yieldably supported member for arresting movement thereof and said element, and a second element movable with the gas displacement member initially spaced from said first element and adapted to contact therewith in the further downward movement of said displaced member to further depress said yieldably supported members and to thereby open said normally closed switch. Claims allowed, 7.

12330. Apparatus for determination of moisture content. Britta Franzén-Lutz and Joseph Peter Lutz, Appelviken, Sweden, assignors to Telefonaktiebolaget L M Ericsson, Stockholm, Sweden, a company of Sweden: U. S. patent 2,520,394, issued Aug. 29, 1950.

Apparatus for determination of the moisture content of a sample of at least partly hygroscopic substance reduced to small particles or granules by measurement of the electrical resistance of said sample, comprising a tubular measuring member for containing said sample, two electrodes for the measurement of said resistance, said electrodes being electrically insulated from each other and consisting of a material having good heat conducting properties and high heat capacity, at least one of said electrodes being constituted by a plunger projecting into one end of said tubular member, means for pressing at least one of said electrodes against said sample with a pressure of such a value that the electrical resistance is independent of the fineness of grain and the distribution of the hygroscopic layers, means for heating at least one of said electrodes, and thermostatic means for controlling said heating means so as to maintain said electrode at a constant temperature with relation to the ambient temperature. Claims allowed, 2.

12331. Geophysical prospecting system. James E. Hawkins, Tulsa, Okla., assignor to Seismograph Service Corp., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,513,314, issued July 4, 1950.

In a system of geophysical prospecting, recording apparatus including means for driving a movable record element, prospecting apparatus including means for activating said recording apparatus to produce a record on said record element representative of a characteristic of the earth's subsurface structure, radio position-finding apparatus, and means responsive to operation of said position finding apparatus for governing said recording apparatus to produce a record on said record element of the geographic position at which said first-named record is produced on said record element. Claims allowed, 5.

12332. Radio position determining system. James E. Hawkins, Tulsa, Okla., assignor to Seismograph Service Corp., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,513,315, issued July 4, 1950.

In a position determining system, spaced transmitters for radiating modulated carrier waves, means at a receiving point responsive to the carrier components of said waves for providing one indication representative of the position of said receiving point relative to at least one of said transmitting points, and means at said receiving point responsive to the modulation components of said waves for providing a second indication representative of the position of said receiving point relative to at least one of said transmitting points. Claims allowed, 52.

12333. Radio Survey system. James E. Hawkins, Tulsa, Okla., assignor to Seismograph Service Corp., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,513,316, issued July 4, 1950.

In a position determining system, three spaced transmitters for radiating continuous waves of different frequencies, means in part responsive to the radiated wave from one of said transmitters for developing a first signal representative of the difference frequency between the waves radiated by said one transmitter and a second of said transmitters and in-part responsive to the wave radiated from the third of said transmitters for producing a second signal representative of the difference frequency between the waves radiated by said second and third transmitters, and means for modulating said signals upon a common carrier wave for space radiation. Claims allowed, 26.

12334. Radio position determining system. James E. Hawkins and Robert S. Finn, Tulsa, Okla., assignors to Seismographs Service Corp., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,513,317, issued July 4, 1950.

In a position determining system having a receiving point, a pair of spaced transmitters for radiating position signals, means for alternately modulating the signals radiated by said transmitters with reference signals, and receiving and translating apparatus at said receiving point jointly responsive to said position indicating and reference signals for producing two indications respectively representative of the position of said receiving point relative to different ones of said transmitters.

A wave signal transmission system comprising a first transmitter including means for radiating a signal at one frequency, means for pulsing said signal, a second transmitter for continuously radiating a second signal at a different frequency, and a reference signal transmitter including means for receiving and heterodyning said signals to produce beat frequency signal pulses and means responsive to said beat frequency signal pulses for radiating corresponding reference signal pulses. Claims allowed, 36.

12335. Radio position finding system. James E. Hawkins and Beverly W. Koeppel, Tulsa, Okla., assignors to Seismograph Service Corp., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,513,318, issued July 4, 1950.

Wave signal receiving apparatus for translating received space radiated waves into position indications, comprising a receiver operative to receive a first pair of space radiated waves and to heterodyne said waves to produce a first heterodyne signal having a frequency related to the difference frequency between said waves, said receiver being alternately operative to receive and reproduce a first reference signal having a frequency representative of the difference frequency between a second pair of radiated waves and modulated upon one of said first pair of radiated waves, a second receiver operative to receive and heterodyne said second pair of radiated waves to produce a second heterodyne signal having a frequency equaling the frequency of said first reference signal, said second receiver being alternately operative to receive and reproduce a second reference signal having a frequency representative of the difference frequency between said first pair of waves and modulated upon one of said second pair of waves, phase measuring means excited by said signals in pairs and operative to measure the phase relationship between said first heterodyne and second reference signals and between said second heterodyne and first reference signals to provide two indications of the position of said receiving system relative to two displaced sources of said waves, and signal responsive-signal level control means for maintaining substantial amplitude equality between the signals exciting said phase measuring means. Claims allowed, 14.

12336. Geophysical prospecting system. James E. Hawkins, Tulsa, Okla., assignor to Seismograph Service Corp., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,513,319, issued July 4, 1950.

In a system of geophysical prospecting, recording apparatus including means for driving a movable record element, prospecting apparatus including means for activating said recording apparatus to produce a record on said record element representative of a characteristic of the earth's subsurface structure, radio elevation finding apparatus, and means responsive to operation of said elevation finding apparatus for governing said recording apparatus to produce a record on said record element of the earth's elevation at the location at which said first-named record is produced on said record element. Claims allowed, 7.

12337. Radio position determining system. James E. Hawkins, Tulsa, Okla., assignor to Seismograph Service Corp., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,513,320, issued July 4, 1950.

A system for in part utilizing the modulated carrier waves radiated from a plurality of geographically spaced broadcast transmitters to determine the position and elevation of a receiving point, comprising a fixed station, a mobile station separated from said fixed station and located at said receiving point, receiving means at each of said stations for separating the carrier wave components of said waves from the modulation components thereof, mixing means at each of said stations for heterodyning in pairs the carrier wave components of said waves to develop at least two position signals at each station, a pair of transmitters at said fixed station for radiating elevation signals of different frequencies and for transmitting the position signals developed at said fixed station to said mobile station, means at said fixed station for heterodyning said elevation signals to develop an elevation reference signal and for transmitting said elevation reference signal to said mobile station, additional receiving means at said mobile station for receiving and separating the position and elevation signals radiated from the transmitters at said fixed station, phase-measuring means at said mobile station for measuring the phase relationship between each position signals developed at said mobile station and the corresponding position signal developed by said additional receiving means, thereby to produce indications identifying the position of said receiving point relative to said broadcast transmitters, receiving means at said mobile station for reproducing said elevation reference signal, mixing means at said mobile station for heterodyning the elevation signals reproduced by said additional receiving means to produce a second elevation reference signal, and phase-measuring means at said mobile station for measuring the phase relationship between said elevation reference signals to provide an indication of the elevation of said receiving point relative to the elevation of at least one of the transmitters at said fixed station. Claims allowed, 31.

12338. Radio location system. James E. Hawkins, Tulsa, Okla., assignor to Seismograph Service Corp., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,513,321, issued July 4, 1950.

A combined pulse-transit time and phase-comparison system of position determination, comprising transmitting apparatus for concurrently producing pulsed signals for phase and pulse transit time comparison, and receiving apparatus remote from at least a portion of said transmitting apparatus and including phase-measuring means and pulse transit time comparison means both responsive to said signals for producing separate indications representative of the position of said receiving apparatus relative to at least one of the sources of said signals. Claims allowed, 44.

12339. Radio-location system. James E. Hawkins, Tulsa, Okla., assignor to Seismograph Service Corp., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,513,322, issued July 4, 1950.

A pulse-transit time radio-location system, comprising a first transmitter for radiating a first signal of one frequency, a second transmitter for producing a pulsed signal of different frequency, a third transmitter for radiating a carrier signal at a third frequency, heterodyning means for heterodyning said first and pulsed signals to produce a pulsed reference signal having a frequency related to the beat frequency between said first and pulsed signals, modulating means for modulating said pulsed reference signal upon the carrier signal radiated by said third transmitter, and receiving apparatus including pulse transit time comparison means responsive to the pulsed signals produced by said second and third transmitters for producing an indication representative of the relative positions of said receiving station and at least one of said transmitters. Claims allowed, 19.

INDEX

Abstract
Alfvén, Hannes 12153
Aliverti, Giuseppina 12182
Andrée, H 12287
Antsyferov, M. S 12175

Bardeen, Thomas 12291
Barnes, G. W., Jr 12324
Bartels, Julius 12158, 12184
Bateman, J. D 12279
Beamer, W. H 12305
Benfield, A. E 12149
Benson, A. C 12155
Bernholtz, Ben 12269
Berson, I. S 12260
Bethune, P. de 12234
Birch, Francis 12217
Blankenship, E. B 12232
Boaga, Giovanni 12128
Bödvarsson, Gunnar 12146
Bolo, Robert 12141, 12147
Bowen, W. A 12156
Brannock, W. W 12218
Brekhovskikh, L. M 12167, 12168
Breyer, Friedrich 12240
Brockman, F. G 12303
Bruet, E 12220
Bucher, W. H 12221, 12222
Buchheim, Wilhelm 12259, 12272
Bukhnikashvili, A. N 12203
Bullard, E. C 12150, 12151
Bureau des Recherches géologiques et géophysiques 12276
Bush, R. E 12286

Cagniard, Louis 12152
Cantos Figuerola, José 12264
Carome, E. F 12258
Carreño, Alfonso de la O 12145
Castet, J 12161
Castro, Honorato de 12142
Ceng, Youngtsen 12148
Chamberlain, Owen 12309
Chang, C. Y 12148
Clark, A. R 12269
Closs, Hans 12245
Coulomb, Jean 12178, 12200
Crumrine, K. C 12273
Csongor, Eve 12213
Cunietti, Mariano 12131

Dahlberg, R. S., Jr 12297
da Silva Gamerio, José 12248
de Andrade, Adalberto 12248, 12249
de Sitter, L. U 12246
Dietert, H. W 12329

Abstract
Di Filippo, Domenico 12189
Dix, C. H 12169
Dodson, R. W 12305
Doll, H. G 12285, 12323
Dos Reis, Arrude 12248
Dupouy, G 12162

Eblé, Louis 12143
Eckhardt, E. A 12236
Emery, K. O 12229
Enenstein, B. S 12270
Ewing, Maurice 12170, 12187, 12188

Fearon, R. E 12295, 12311, 12312, 12313, 12314, 12315, 12316
Finn, R. S 12334
Fontseré, Eduardo 12194, 12195
Franzén-Lutz, Britta 12330
Fritsch, Volker 12267
Frolov, A. I 12137, 12138

Gassmann, Fritz 12164
Geophysical Directory 12237
Gilchrist, Lachlan 12269
Gilmour, Andrew 12255
Gimeno Riutort, Antonio 12196
Giorgi, Maurizio 12180
Gloden, Albert 12132
Goguel, Jean 12147, 12277
Goldin, A. S 12280
Gougenheim, André 12141
Green, A. E 12166
Grenet, Gaston 12160
Grushinskii, N. P 12136, 12193
Guimarães, Djalma 12210
Gutenberg, Beno 12190

Hamilton, G. R 12187
Hardtwig, Erwin 12201, 12235
Hawkins, J. E 12331–12339
Hée, Arlette 12216
Hersey, J. B 12187
Hodge, M. W 12154
Holmes, Arthur 12212
Honnell, P. M 12289
Howe, H. H 12157
Hughes, D. S 12231, 12232
Hurley, P. M 12252
Hvoroslev, M. J 12239

Irons, H. R 12251

Jarovoy, Michel 12216
Jeffreys, Harold 12209
Jones, H. J 12231

Abstract
Jones, P. H. 12275
Jones, W. R. 12238
Joset, Alain 12179

Kanai, Kiyoshi 12172, 12176
Kanne, W. R. 12300
Kazanskii, I. A. 12127, 12129
Kebuladze, V. V. 12203
King, C. M. 12329
King, P. B. 12226
Kilchling, Karl 12133, 12134, 12135
Kleiber, Joseph 12216
Koeppel, B. W. 12335
Korff, S. A. 12206, 12207
Krasnow, Shelly 12317
Krey, Theodore 12261
Ku, K. G. 12148

Lehmann, Inge 12183
Lorenz, Hans 12257, 12263
Lozano Calvo, Luis 12130
Lundberg, H. T. F. 12298
Lutz, J. P. 12330
Lynch, J. J. 12202

Maclen, R. L. 12280
Maher, J. C. 12275
Maple, E. 12156
Marcelli, L. 12189
Martin, Jean 12179
Martins da Silva, João 12248
Matschinski, Mathias 12223
Menis, S. 12181
Mihailovič, Jelenko 12191
Mims, R. L. 12232
Modriniak, N. 12250
Molard, Pierre 12178
Moore, A. F. 12155
Morelli, Carlo 12126, 12181
Morris, W. L. 12319
Morrow, G. R. 12321
Morrow, M. E. 12322
Morton, G. A. 12304
Müller-Deile, G. 12265
Müller, Max 12274

Nathan, Hans 12219
Nedeljković, R. L. 12192
Neil, H. G. 12301
Nesbitt, R. H. 12256
Neufeld, Jacob 12302
Niggli, Ernst 12164

Offner, Franklin 12328
Oliphant, C. W. 12177
Oñate Espinosa, Roberto 12244

Parker, G. G. 12198
Paul, Bernt 12268
Perlow, G. J. 12299
Pettersson, Hans 12186

Abstract
Poisson, Charles 12159
Poldini, E. 12205
Press, Frank 12170, 12187, 12188
Pringle, R. W. 12278

Quarles, Milton, Jr. 12262

Ramachandra Rao, M. B. 12241
Ramspeck, Adolf 12266
Reich, Hermann 12185
Reichertz, P. P. 12307
Roberts, A. 12285
Roche, Alexandre 12163
Rodgers, John 12227
Rodriguez Aguilar, Manuel 12243
Rohrer, E. R. 12280
Rohrer, R. H. 12208
Rothé, Jean 12165
Rothersberger, Hans 12164
Runcorn, S. K. 12155

Scherbatskoy, S. A. 12296
Schleusener, Alfred 12140
Schmitz, H. P. 12204
Schonstedt, E. O. 12251
Schroeder, C. A. 12299
Schulze, G. A. 12266
Schumann, H. 12288
Segre, E. G. 12309
Seigel, H. O. 12233
Selenyi, P. 12290
Sezawa, Katsutada 12172, 12176
Shamos, M. H. 12310
Shipman, J. D., Jr. 12299
Shivers, P. F. 12320
Silverman, Daniel 12318
Singer, S. F. 12156
Skeels, D. C. 12144
Smulski, T. J. 12325, 12326, 12327
Solaini, Luigi 12182
Stead, F. W. 12281, 12282
Steenland, N. C. 12188
Steinmueller, R. E. 12329
Stringfield, V. T. 12198
Sundquist, K. J. 12199
Sweet, R. C. 12292
Swift, Gilbert 12311–12316
Szalay, A. 12213

Thayer, J. M. 12311, 12316
Thompson, J. B. 12252
Thomson, W. T. 12171
Tikhonov, A. N. 12271
Tiratsoo, E. N. 12214, 12215

U. S. Geological Survey 12253, 12254
Uzelač, Miroslava 12193

Valle, P. E. 12173, 12174
Vening Meinesz, F. A. 12224
Vladimirov, A. T. 12230

Abstract
Wadia, D. N. 12242
Weaver, Paul 12228
Weber, E. K. 12164
Weisz, P. B. 12308
Weng, W. P. 12247
Werner, P. W. 12199
White, D. E. 12218
White, W. C. 12211
Williams, David 12238
Wilson, J. T. 12225
Wilson, V. C. 12306

Abstract
Worzel, J. L. 12187, 12188
Wulf, O. R. 12154
Wyckoff, R. D. 12293

Yagoda, Herman 12211
Ylanan, C. W. 12197

Zen'kovich, V. P. 12230
Zerna, W. 12166
Ziloff, Wladmir 12283
Zuschlag, Theodore 12294, 12298

○

Geophysical Abstracts 143 October-December 1950

(Numbers 12340–12513)

GEOLOGICAL SURVEY BULLETIN 976-D

DEPARTMENT OF THE INTERIOR
March 3, 1849

Geophysical Abstracts 143 October-December 1950

(Numbers 12340–12513)

By MARY C. RABBITT *and* S. T. VESSELOWSKY

GEOLOGICAL SURVEY BULLETIN 976-D

Abstracts of world literature contained in periodicals, books, and patents

DEPARTMENT OF THE INTERIOR
March 3, 1849

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1951

UNITED STATES DEPARTMENT OF THE INTERIOR

Oscar L. Chapman, *Secretary*

GEOLOGICAL SURVEY

W. E. Wrather, *Director*

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price 20 cents (paper cover). The printing of this publication has been approved by the Director of the Bureau of the Budget, February 1948.

CONTENTS

Page
Introduction ---- 211
Earth physics ---- 213
  Gravity ---- 213
  Magnetism ---- 219
  Seismology ---- 223
  Electricity ---- 234
  Radioactivity ---- 235
  Heat ---- 237
  Volcanology ---- 237
  Tectonophysics ---- 240
  Internal constitution ---- 241
Exploration geophysics ---- 242
  General ---- 242
  Gravimetric methods ---- 243
  Magnetic methods ---- 245
  Seismic methods ---- 246
  Electrical methods ---- 248
  Well logging ---- 252
  Technical aids ---- 253
Patents ---- 254
  Magnetic methods ---- 254
  Seismic methods ---- 255
  Electrical methods ---- 257
  Radioactive methods ---- 258
  Thermal methods ---- 259
  Well logging ---- 260
  Technical aids ---- 263
Index ---- 265

GEOPHYSICAL ABSTRACTS 143, OCTOBER-DECEMBER, 1950

By MARY C. RABBITT and S. T. VESSELOWSKY

INTRODUCTION

Geophysical Abstracts are prepared by the Geophysics Branch of the Geological Survey, United States Department of the Interior, as an aid to those engaged in geophysical research and exploration. Periodicals, books, and patents are regularly searched for material dealing with geophysical exploration and with basic earth physics as represented by the fields of gravity, magnetism, electricity, seismology, radioactivity, and heat.

Abstracts in this issue have been grouped in three sections dealing with earth physics, exploration geophysics, and patents. The first section has been further divided into sections on gravity, magnetism, seismology, electricity, radioactivity, heat, volcanology, tectonophysics and the internal constitution of the earth. The section on exploration geophysics covers gravimetric, magnetic, seismic, electric, and radioactive methods, well logging, and technical aids. Within each group the order of the abstracts is as follows: general papers, bibliographies, and reviews; theory; instruments; methods and techniques; observations.

As many readers may not have ready access to the source material, an effort is made to include all significant new material in these abstracts. Where geographic names quoted differ from the decisions of the United States Board on Geographical Names, the latter are added in brackets.

Geophysical Abstracts 1–86 and 112–127 were issued as Information Circulars by the Bureau of Mines, and 87–111 were issued as Bulletins of the Geological Survey. Beginning with 128, Geophysical Abstracts are published as Bulletins of the Geological Survey.

All Geophysical Abstracts published as Information Circulars are now out of print. Geophysical Abstracts issued as Bulletins of the Geological Survey (except Nos. 87 and 88 which are out of print) may be purchased as single copies or by subscription from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. For subscription, the Superintendent will accept a deposit of $5 in payment for subsequent issues. When this fund is near depletion, the subscriber will be notified. The deposit may also be used to purchase any other publication from the Superintendent of Documents.

Acknowledgments.—Special thanks are due James R. Balsley, Jr., David F. Barnes, Gordon D. Bath, William J. Dempsey, Roland G. Henderson, H. R. Joesting, Jack L. Meuschke, Irwin Roman, Nancy Ann Smead, and Isidore Zietz who have prepared the abstracts signed J. R. B., D. F. B., G. D. B., W. J. D., R. G. H., H. R. J., J. L. M., I. R., N. A. S., and I. Z.

EARTH PHYSICS

GRAVITY

12340. Sergeev, M. N. Potential produced by an elliptic lamina of negligible thickness [in Russian]: T͡Sentral'nyĭ nauchno-issledov. Inst. geodezii, aeros"emkiikartografii, Trudy, no. 51, pp. 112–116, 1948.

A new method of solution for the value of Newton's potential in points lying on the central perpendicular to the elliptic lamina is given in a form more convenient for application. This problem was previously solved by Riemann who treated the membrane as a limiting case of a triaxial ellipsoid of a very small height, Reimann's solution being given in the form of elliptic integrals of the first and the third kind.—*S. T. V.*

12341. Júdice, António. La determination de la pesanteur normale en géodesie [The determination of normal gravity in geodesy]: Geofis. Pura e Appl., v. 16, fasc. 1–2, pp. 7–12, 1950.

The usual method of determining the reference ellipsoid by dividing the sphere into curvilinear rectangles, forming the average value of the gravity anomalies obtained at the points inside of any rectangle and forming a series of spherical functions with a number of terms corresponding to the desired precision, is reviewed. It is concluded that this procedure is fully justifiable and insures the necessary accuracy of the results.—*S. T. V.*

12342. Júdice, António. A problema da figura da terra [The problem of the figure of the earth]: Sindicato Nacional dos Engenheiros Geógrafas Publicacões, Ser. 1, no. 1, 121 pp., 1950.

A critical analysis is made of the methods for determining the figure of the earth from gravitational measurements. The study is theoretical in its approach.

The theory of Pizzetti-Somagliana is formulated and proven, as the following theorem: if a volume of mass endowed with gravitational property, rotating with a known angular velocity, is bounded by an equipotential surface, the gravitational potential created by the mass in the exterior space is uniquely determined and is independent of the inner structure of the mass. In the derivation of this theorem, a development in series of spherical functions is employed. The formula of Stokes is discussed and different methods used in reduction of gravimetric observations, such as reduction in free air, reduction by suppressing masses exterior to geoid—the Bouguer generalized method, suppressing exterior masses while simultaneously assuming the volumes of oceans fitted to a density equal to that of the earth's crust, the method of Helmert, and the method of Rudzki.

The method of the determination of the geoid best fitted to observations and the formula of Burns is also presented. The methods of the determination of the reference ellipsoid are discussed.—*S. T. V.*

12343. Takeuchi, Hitoshi. On the earth tide of the compressible earth of variable density and elasticity: Am. Geophys. Union Trans., v. 31, no. 5, pt. 1, pp. 651–689, 1950.

A theoretical study of earth tides is presented in which several earth models with internal constitutions inferred from recent seismological studies are employed. The equations of motion of a material point in an initially stressed, self-gravitational earth, together with the Poisson equation form the fundamental differential equations of the investigation. The numerical integration is carried out in detail for elastic deformation by tidal action under various hypotheses as to elasticity and density distributions.

The values of Love numbers, *k* and *h*, and Lambert's number, *l*, calculated for the model earth agree quite well with those obtained from observations on earth tides. It is concluded that the static elastic constants determined by the study of earth tides can be regarded as the same as the dynamic elastic constants determined by seismologic studies. The largest value for the rigidity of core compatible with the observations is believed to be 10^9 to 10^{10} c.g.s. units.—*R. G. H.*

12344. Magnitskii, V. A. Reductions of the gravity force [in Russian]: T͡Sentral'nyi nauchno-issledov. Inst. geodezii, aeros"emki i kartografii, Trudy, no. 51, pp. 46–61, 1948.

Reductions of gravity measurements important in the studies of the structure of the earth's crust are considered. In such problems, the Fayé reduction is of no use because it results simply in displacing downward all disturbing masses without changing the general gravitational pattern. The same is true of the Poincaré-Pray reduction. The topographic reduction, as applied by Hayford and Bowie, has the advantage of eliminating the gravitational effect of external relief, but it is affected by the unavoidable assumption of ground density, never exactly known. Another drawback is that it displaces disturbing masses downward through distances varying from point to point. Various isostatic reductions represent an approach to a geological reduction. They are useful in separating the influence of remote masses from local ones. In this process, it is important to take into account the geologic history of the region, often using information from seismologic and other sources.

Formulas are determined for the effect of masses, composing the external relief features, for masses distributed at great distances, vertical or horizontal, and for masses lying in the vicinity of the station, the most interesting to the geologist.

Use of sea level as the basic surface for the reductions is not important. Any confocal ellipsoid containing the same mass, can be used as a base surface, producing the same external effect.

Formulas are also derived for the anomalies of a region as a function of the heights of the corresponding geoid and as functions of the deviations of the plumb line.—*S. T. V.*

12345. Evseev, S. V. Reduction of gravity force in mountainous regions [in Russian]: T͡Sentral'nyi nauchno-issledov. Inst. geodezii, aeros"emki i kartografii, Trudy, no. 51, pp. 83–111, 1950.

The author points out the scientific and practical advantages of isostatic reductions, as compared with others such as the Fayé, Bouguer, or topographic reductions, but he also shows the necessity of applying to every geophysically isolated region its own, specifically modified, isostatic reduction. This modification should be made in accordance with the known or assumed distribution and density of underground masses, thickness of sialic layer, and similar features. The Caucasus has never been investigated in this way. The author analyzes his own computation methods and those of Hayford-Pratt; Heiskanen, who previously investigated a portion of the Caucasus; Vening-Meinesz, and emphasizes that the boundary of the regional compensation, other data, are to be tentatively chosen.

One hundred gravitational stations, between 41° and 44° N. latitude were selected, thus covering the main Caucasus Mountains. The following isostatic reductions and anomalies were calculated: local, according to Hayford, with $T=96$ km. and density $\mu=0.267$; local, according to Airy-Heiskanen, with normal depth $T_\Delta=60$ km., density $\mu=0.267$ and density variation $\Delta\mu=0.6$; regional, according to Heiskanen, assuming radii of the compensating region as 166.7, 38.9 and 871.1 km.; anomaly, using the Vening-Meinesz reduction. The smallest standard deviation was found for the regional reduction with the radius of 871.1 km. This radius also gave good reductions for the various stations as far as their independence from the respective altitudes is concerned. The results are presented in tables and on a map showing the isostatic anomalies of the region.

The necessity of isostatic reductions is indicated in the establishment of the formula for the standard gravity force, when using Stokes' formula, and in cases of interpolation or extrapolation of the gravity values to points where no gravitational determinations were made. In mountainous countries these points are always the inaccessible peaks of the mountains.—*S. T. V.*

12346. Melchior, P. J. Sur l'influence de la loi de répartition des densités à l'intérieur de la terre dans les variations lunisolaires de la gravité en un point. [On the influence of the distribution of density in earth's interior on the lunisolar variations of gravity at a point]: Geofis. Pura e Appl., v. 16, fasc. 3–4, pp. 105–116, 1950.

Observations of lunar and solar variations of gravity at various points of the earth show that it is necessary to distinguish three different controlling factors: the gravitational effect of the two celestial bodies determined by Newton's law and changing with their position relative to the point of observation, deformation of the earth, and the variation of the gravitational potential at the point of observation owing to this deformation. The deformation of the earth is evidently determined by its rigidity. Love's equation connecting the rigidity δ with h, the amplitude of the tide in the earth's crust and with k, the ratio of the variation of the potential owing to deformation to disturbing potential is $\delta=1+h-3/2\ k$.

Gravity variations are very difficult to observe because of their smallness. Results obtained by different scientists do not agree among themselves and with the Love relation. The increase of density toward the center of the earth increases the effect of elasticity, and the factor δ in Love's equation is related to the deviations of the plumb line caused by displacement of terrestrial masses. By assuming four different laws of density variation in the earth's interior, proposed by Haalck and Bullen, discrepancies among the different results can be eliminated and good agreement between computed and observed values obtained. However, Love's equation must be considered only as approximation because other factors such as displacement of the pole also cause gravity variation at a point of another periodicity.—*S. T. V.*

12347. Voit, H. Über die beste Dimensionierung des Bifilargravimeters [The optimum dimensions of the bifilar gravimeter]: Geofis. Pura e Appl., v. 15, fasc. 1–2, pp. 90–110, 1949.

To determine the optimum conditions controlling the operation of the gravimeter, equations are derived determining its sensitivity as the function of different constants of the instrument. From the analytical expression of the sensitivity, optimum conditions are determined in terms of the dimensions and properties of different members. This is followed by the determination of mechanical stresses produced in the springs which should be reduced as much as possible to avoid permanent deformations, inevitably causing the drift of the zero point. The sensitivity of the gravimeter is estimated as 1 mm. deflection for gravity variation of $5.116 \times 10^{-10} g$. Such sensitivity should be sufficient to make noticeable the influence of the tides on the gravity force. Temperature inside the instrument housing must remain constant within $\pm 10^{-5\circ}$ C., but this condition can be attained by the use of sufficient thermal insulation and by thermostatic heating.—*S. T. V.*

12348. Tsuboi, Chuji. Thickness of the isostatic earth's crust in various parts of the United States of America: Tokyo Univ., Geophys. Inst., Geophys. Notes, v. 3, no. 5, 37 pp., 1950.

The thickness of the isostatic earth's crust in the United States has been determined as approximately 120 km. if the Pratt hypothesis is adopted and about 60 km if Airy hypothesis of isostasy is assumed. Because it can be proved mathematically that the underground mass distribution conforming to the Pratt hypothesis of isostasy with depth of compensation D produces the same gravity field on the earth's surface as does that conforming to the Airy hypothesis with the crustal thickness $D/2$, there can be no preference so far as gravity data alone are concerned.

In most determinations of the thickness of the isostatic earth's crust, the thickness is assumed uniform throughout the area in question. In the present study the attempt is made to determine whether or not the thickness of the crust, according to Airy's hypothesis, is uniform throughout the United States by using the harmonic-series method of the writer in which the thickness of the crust can be found directly from the Bouguer anomalies and topography. The conclusions may be applied to Pratt hypothesis as well.

The usual method for determining the thickness d of the crust is to find the value which will make the sum of squares of the isostatic anomalies calculated for that d a minimum. The alternative is to find the value d which makes the squares of the isostatic anomalies integrated over the region in question a minimum.

The whole area of continental United States can be divided in nine equal rectangles, with the number of gravity stations in each ranging from 23 to 130. The most probable values of d for each rectangle range from about 47 to 133 km., on the assumption of perfect isostasy.

No comparison of the results obtained from gravitational considerations with seismologic evidence is possible for the total area of the United States. However, in the rectangle in the Sierra Nevada where $d=47$, Chakrabarty and Richter have calculated a thickness of 42 km., from seismological observations.—*S. T. V.*

12349. Beer, Michael. Measurements of gravity in the Canadian Arctic and Greenland: Canadian Jour. Research, Sec. A., v. 28, no. 5, pp. 535–541, 1950.

During the summer of 1948, determinations of gravity were made with the Dominion Observatory pendulum apparatus at Goose Bay, Labrador (981.312 gals); Thule, Greenland (982.923 gals); Resolute Bay, Cornwallis Island (982.876 gals); and Frobisher Bay, Baffin Island (982.167 gals). Free air anomalies are —0.046, —0.003, +0.019, and —0.033 milligals respectively and are similar to Bouguer anomalies because of the low elevation of the stations. Anomalies at Thule and Resolute Bay are not large enough to indicate any great departure from isostasy or from theoretical gravity as given by the International formula. Anomalies at Goose Bay and Frobisher Bay, though moderately large, are not larger than many that have been observed in other parts of the country. Nørgaard's determination at Thule is confirmed.—*M. C. R.*

12350. Norges Geografiske Oppmålings virksomhet. Beretning 1949 [Norway Geogr. Survey activity. Annual report for 1949], 42 pp., 1950.

During the year gravimeter measurements were made to tie the Oslo Observatory to the National Physical Laboratory at Teddington, the Rikets Allmanna Kartverk in Stockholm, and the Geodaetisk Institut of København. Absolute gravity determinations were made at Oslo, København, and Teddington using pendulum apparatus. Gravimetric measurements were made along several previously surveyed profiles, establishing eleven first order stations. Precise leveling has been carried out in different regions of southern Norway over a total length of 221 km. Norwegian and Swedish geodetic networks were tied by first order triangulation with 13 Norwegian stations involved. These observations are to be used in the construction of the European network in accordance with decisions of the International Geodetic Association. Extensive topographic work, covering some 3,000 sq. km., was done using photogrammetric methods.—*S. T. V.*

12351. Bogdanov, A. A., Gurevich, B. L., and Shereshevskaîa, S. ÎA. Gravity anomalies and their relation to the principal tectonic elements in the western regions of the Ukrainian S. S. R. [in Russian]: Akad. Nauk SSSR Izv., Ser. geog. i geofiz., v. 14, no. 3, pp. 223–231, 1950.

Gravitational investigations of the eastern portion of the Carpathian Mountains were begun over fifty years ago. Between 1932 and 1936 determinations of high precision were made at 42 stations. Since 1947 numerous gravimetric determinations have been made. Important data were obtained in 1948 on three profiles extending across the main ridge of the Carpathian Mountains, along the lines from Uzhgorod to L'vov, from Mukachevo to L'vov, and from Solotvin to Galich. All three gravity profiles are similar and are characterized by large negative anomalies, with minima (after Bouguer reductions) below the main ridge of —60 mgal. along the Uzhgorod-L'vov profile and —95 mgal. along the other two.

These gravity minima cannot be explained by assuming a lower density of the upper layers, and it is therefore concluded that the real causes of these anomalies are the deep displacements of subcrustal masses which took place at the depth of many tens of kilometers.—*S. T. V.*

12352. Cook, A. H. Measurements of gravity in Ireland: Dublin Inst. for Advanced Studies, Geophys. Mem. no. 2, pt. 1, 28 pp., 1950.

A detailed report is given of the measurements of gravity made in 1949 in Cambridge, Dublin, Sligo, Galway, and Cork. The instrument used was the Cambridge pendulum apparatus designed by Sir Gerald Lenox-Conyngham, consisting of two pendulums of period about 1.01 sec. swinging together with equal amplitude and opposite phase. To reduce damping, the pendulums were enclosed in containers in which air pressure was reduced to about 30 mm. of mercury. The pendulums are of invar and have hard steel knife edges resting on agate planes. The timing arrangements consisted of beams of light reflected from mirrors on the pendulums and recorded photographically with time marks controlled by the crystal frequency standard, oscillating at 10,000 cycles per second. The report contains a detailed description of the measurements and calculations of the errors and corrections.

Dunsink Observatory, about four miles northwest of Dublin, has been chosen as the base station for Ireland. Its coordinates are 53°23′13.1″ N. lat., 6°20′16.5″ W. long., elevation 80.8 m. above mean sea level. Differences of gravity from Cambridge were found by least squares as: Dunsink Observatory, +120.84 mgal. ±0.56; Sligo Courthouse, +197.28 mgal. ±0.82; Galway University College, +96.91 mgal. ±0.64; Cork University College, −22.51 mgal. ±0.87.—*S. T. V.*

12353. Lejay, Pierre. Étude gravimétrique des Iles Philippines [Gravimetric survey of the Philippine Islands], 130 pp., Imprimerie de T'ou-se-we, Shanghai, 1939.

A gravimetric survey of the Philippine Islands was made in 1938, using two Holweck-Lejay pendulums. About 190 stations, forming over 20,000 km. of profiles, were occupied at elevations ranging from sea level to 2,400 m. above sea level. Significant positive anomalies were found along mountain ridges in contrast to the findings of a previous survey on the continent of Asia. Results of the gravity determinations are given in a table and as a map of Bouguer anomalies.—*S. T. V.*

12354. Vening Meinesz, F. A. Gravity expeditions at sea 1923–1938: Netherlands Geodetic Comm. Pub., v. 4, 233 pp., 1948.

This publication contains the complete results of the gravity expeditions at sea made by the Netherlands Geodetic Commission up to the year 1938. Data are included for 844 stations, isostatically reduced according to the Hayford-Bowie method and according to the Airy-Heiskanen method, based on the hypothesis of a floating rigid crust 40 km. thick, and also under the assumption of regional compensation for crustal thicknesses of 20 and 30 km.

Methods of reduction are discussed in relation to views on the constitution of the upper layer recently formed from a study of gravitational and seismological data. Special chapters are devoted to the results of gravity surveys in the Indonesian Archipelago, over and near volcanic islands, over the continental margins, and over the oceans in general. Gravity profiles discussed in the text, maps with calculated isostatic anomalies, a geological map constructed from these data, and two bathymetric charts are included.—*S. T. V.*

MAGNETISM

12355. Alfvén, Hannes. On the origin of the terrestrial and solar general magnetic field: Arkiv för Fysik, Band 2, Häfte 3, p. 221, 1950.

There is good evidence for the assumption that the terrestrial and solar magnetic fields are due to internal electric currents. The problem is to devise a self-exciting electric generator to be made of elements existing in the interiors of the earth and sun.

A system of whirls in the interior of the earth may give the same effect as a homopolar inductor which, surrounded by a system of rotating cylinders, acts as a self-exciting electric generator and produces a magnetic field that, outside the generator, is approximately of dipole type. A simple calculation shows that even very slow internal motions are enough to produce a field of the observed order of magnitude.—*N. A. S.*

12356. Truesdell, C. On the effect of a current of ionized air upon the earth's magnetic field: Jour. Geophys. Research, v. 55, no. 3, pp. 247–260, 1950.

An equation governing the perturbation field induced by the motion of a conducting fluid in a uniform magnetic field is derived and a general solution for the steady state case is presented. From the study the following facts concerning local magnetic disturbances produced by upper atmospheric winds are deduced: The first-order perturbation problem is purely magnetic. Any given component of magnetic perturbation field may be analyzed independently of the others. It is futile to conjecture the nature of the upper atmospheric winds and the extent of the ionization of the air as an infinite number of different conjectures can lead to any one perturbation field. In the static case, each component of the perturbation field is a Newtonian potential and hence any static perturbation field arising from a localized disturbance falls off, according to the inverse first-power law for large distances. In the static case a definite center of disturbance and strength of disturbance exist for any given component, and these may be calculated from magnetic observations at large distances from the center.—*M. C. R.*

12357. Blaha, Friedrich. Über eine Methode den magnetischen Kraftverlauf räumlich sichtbar zu machen [A method of making visible the spatial pattern of magnetic forces]: Zeitschr. Naturf., Band 5a, Heft 4, pp. 233–234 and table 228b., 1950.

The pattern of the magnetic field between pole shoes of arbitrary shape in a machine or an apparatus may be made visible by a method based on the glow discharge produced when an appropriate electric voltage difference is applied under vacuum. Replicas of the pole shoes are prepared, covered with a special lacquer, and put in a conveniently designed container in the predetermined relative position. By maintaining vacuum in the container and applying a sufficiently high voltage difference between the pole shoes, a visible glow discharge can be produced, representing the pattern of the magnetic field.

Seven different configurations are shown by photographs including two oppositely directed conical pole shoes, an acorn placed perpendicular to a plate, and a sharp point directed into a cavity. The disturbing effect of an extraneous piece of iron on the original field pattern may also be made visible and reproduced on a photograph.—*S. T. V.*

12358. Kondorskii, E. I. The theory of magnetic properties of conglomerates and powdered substances [in Russian]: Akad. Nauk SSSR Izv., Ser. geog. i geofiz., v. 14, no. 4, pp. 294–301, 1950.

In prospecting by magnetic methods it often becomes necessary to determine magnetic susceptibility of combinations of magnetic and nonmagnetic substances. Empirical formulas used for this purpose are derived only for certain special cases and are often quite inaccurate. From theoretical analysis of the problem, taking into account the inner demagnetizing effect of magnetic particles, the following formula for susceptibility of a mixture is derived:

$$1/A[\sqrt{(1-BK)^2+2AvK}-(1-BK)], \text{ where } A=8\pi/3(2+v),\ B=4\pi/3(4v-1),$$

v is the volume concentration of the magnetic substance in the mixture and K its magnetic susceptibility. The influence of elastic stresses on the magnetic susceptibility of mixtures is studied and the necessary corrections to the derived formula are given. This phenomena can be noticed in studying the magnetic anomalies of different formations in regions of high seismicity.—*S. T. V.*

12359. Tsubokawa, Ietsume. A new type magnetometer: Jour. Geomagnetism and Geoelectricity, v. 1, no. 1, pp. 10–11, 1950.

A Helmholtz coil is mounted perpendicular to the horizontal and vertical axis of a theodolite. Within the Helmholtz coil a rotating pick-up coil is set perpendicular to the axis of the theodolite. The e. m. f. generated in the pick-up coil is amplified and detected with a magic eye (6G5). Azimuth and dip of the geomagnetic field are determined by orienting the theodolite in horizontal and vertical planes for null as indicated by the magic eye. Horizontal intensity is determined by measuring the horizontal field of the Helmholtz coil necessary to give a zero reading when the axis of the rotating coil is less than 4° from vertical. The potential drop across a standard resistance as measured against a standard cell is used to determine the field of the Helmholtz coil whose constant was determined by comparison with the standard value. Field use on Shikoku for three months in 1948 demonstrated the practicability of this instrument.—*W. J. D.*

12360. Morelli, Carlo. Nuovi criteri per la sistemazione magnetica [New criteria in magnetic investigations]: Annali Geofis., v. 3, no. 3, pp. 349–355, 1949.

With modern instruments, it is possible to measure D with an accuracy of $\pm 0.1'$ and H or Z with an accuracy of ± 5 gammas. In northern Italy, where I averages about 62° and H 21,000 gammas, an error of 0.5′ in the measurement of I involves an error of more than 13 gammas as in Z. This imposes the selection of H or Z as initial observation data. To increase the final accuracy measurements should be repeated several times. In general, relative measurements, ΔD, ΔH, and ΔZ give greater accuracy, are easier to make, and are much more economical.

For a magnetic survey of an area of about 10,000 sq. km., it is suggested that a certain number of absolute stations of the first order be established some 50 to 150 km. distance apart. These stations are superimposed on a network of relative stations of the second order of precision, with some 10–20 km. distance apart, and finally a denser network of relative stations of the third order. As instruments, portable magnetic theodolites for absolute measurements and Schmidt magnetic balance for relative determinations are suggested. (*See* also Geophys. Abstract 11030).—*S. T. V.*

12361. Wasserfall, K. F. A study of the secular variation of magnetic elements based on data for *D*, *I*, and *H* for Oslo, 1820–1948: Jour. Geophys. Research, v. 55, no. 3, pp. 275–299, 1950.

A general view of the secular variation of the more important magnetic elements may be obtained from annual means of *I*, *H*, and *D* at Dombås, Oslo, Rude Skov, and Potsdam. The *H*-curve shows a steady increase of about 13 gammas per year to about 1908 and then an average decrease of about 22 gammas per year. The *I*-curve is more or less parallel to an inverted *H*-curve, decreasing 1.2′ annually to 1908 and then increasing 1.5′ per year. Besides secular progress, there is a more or less periodic variation evidently caused by variation of the sunspots. There is no indication of an 11-year variation in the *D*-curve, but apparently an approximate periodic variation with a period of about 70 years. The secular curve for *D* moves westward with an average rate of 10.5′ annually to the turning point about 1910 and then decreases toward the east with an average rate of 7.1′ per year. Comparison between secular curves for *H* and the corresponding curves for *I* at eleven magnetic stations between geomagnetic latitudes 50° and 60° north show striking similarity.—*M. C. R.*

12362. Howe, H. H. An anomaly of the magnetic daily variation at Honolulu: Jour. Geophys. Research, v. 55, no. 3, pp. 271–274, 1950.

The grouping of months customarily used in computing mean daily variations is not always suitable. Daily variations of *H* at Honolulu from 1902 to 1936 show both maximum and minimum in the "equinox" group of months.—*M. C. R.*

12363. Nagata, Takeshi and Akimoto, Syun'iti. Magnetic transition points of volcanic rocks: Jour. Geomagnetism and Geoelectricity, v. 2, no. 1, pp. 29–33, 1950.

The thermal change of susceptibility of thirty specimens of volcanic rocks was measured by a ballistic method in a weak magnetic field, several times as much as the geomagnetic field. Specimens were heated to about 660° C. and then cooled to room temperature, the susceptibility being measured every 20° C. during both heating and cooling processes. The susceptibility of all specimens becomes apparently zero at about 600° C., but the mode of change with temperature is not simple. Four general types of changes are recognized: the reversible-ordinary type, in which the susceptibility increases gradually to 400° C. and then decreases abruptly, the change in cooling following almost the same curve; the irreversible-ordinary type, in which the change in heating is similar to the preceding but the cooling curve differs; and the reversible- and irreversible-extraordinary types, in which the thermal change of susceptibility is stepwise. The magnetic-transition points depend on the chemical constitution of the rock. The ordinary-type change is attributed to magnetite grains containing some impurities, but the original ferromagnetic mineral in the extraordinary type could not be identified.—*M. C. R.*

12364. Rikitake, Tsuneji. Magnetic anomalies and the corresponding magnetic centres: Jour. Geomagnetism and Geoelectricity, v. 2, no. 1, pt. 1, pp. 20–24; pt. 2, pp. 25–28, 1950.

A method is proposed for finding the position, intensity, and direction of an underground magnetic dipole from the corresponding vertical intensity anomaly observed at the earth's surface. The dipole terms are the most important in the magnetic anomalies that are due to magnetic matter, the shapes of which do not deviate markedly from a sphere. Application of the method to actual anomalies gives depths of the magnetic centers that roughly agree with the centers of the magnetic matter to which the anomalies are due. From an analysis of the magnetic changes which accompanied the 1940 eruption of Miyake-jima volcano, it was concluded that the depth of the magnetic center was 2.9 km., in good agreement with the conclusions of Takahashi and Hirano that the changes were equivalent to those which would result if a sphere with center situated at a depth of 3 km. lost its susceptibility. In Part 2 the method is extended to cases in which the magnetic anomalies are given in dip, and the changes in dip that accompanied the 1935 earthquake are analyzed.—*M. C. R.*

12365. Nagata, Takeshi, Hirao, Kunio, and Yoshikawa, Haruo. Remanent magnetization of "Pleistocene" deposits—Paleomagnetism in Japan: Jour. Geomagnetism and Geoelectricity, v. 1, no. 2, pp. 52–58, 1949.

The intensity and direction of magnetic polarization in the upper 7 meters of the Narita bed, a horizontal layer of Pleistocene age, were measured with an induction-type magnetometer. The direction of magnetic polarization of each part of the layer is, roughly speaking, not much different from the present geomagnetic field although there is some evidence of regular systematic change with depth. The declination shifts westerly with increasing depth to a maximum at about 5 meters. Fluctuations in both declination and dip have periods of approximately 1,500 to 2,000 years (40 to 50 cm.). Examination of the statistical reliability of the apparent direction of polarization and constitution of remanent magnetism indicates that the direction of polarization ought to agree within a few degrees with the geomagnetic force at the time of deposition of the material.—*M. C. R.*

12366. Giorgi, Maurizio, Medi, Enrico, and Morelli, Carlo. Rilievo magnetico regionale nelle Marche per la istituzione di un Osservatorio Magnetico Centrale [Regional magnetic survey of the Marche region for the establishment of an [Italian] Central Magnetic Observatory]: Annali Geofis, v. 3, no. 2, pp. 143–171, 1950.

The Istituto Nazionale di Geofisica, in planning the erection of a new central magnetic observatory, has conducted preliminary magnetic surveys of many regions in central Italy. Extensive regional magnetic anomalies in Italy make many regions poor sites for a magnetic laboratory. The most promising area was the region along the Fabriano-Iesi-Falconara Alta railway where, from December 1949 to March 1950, detailed and very precise magnetic surveys were made. Three Schmidt magnetic balances were used, one remaining at the base observatory. The average precision of the readings was better than ±5 gammas. More than 400 stations were occupied. The results of the survey show that the selected region is well adapted for the erection of the magnetic observatory.

The report contains numerous tables, readings made at 170 stations, determinations of the average errors, graphs of transient variation of the magnetic vector, and maps. The procedures and methods followed in the survey were based on the results of the special study by C. Morelli. (*See* Geophys. Abstract 12360.)—*S. T. V.*

12367. **Koshikawa, Yoshiaki.** Magnetic survey in the area of topographical deformation of Volcano Usu: Tokyo Univ. Earthquake Research Inst. Bull., v. 27, pts. 1–4, pp. 21–25, 1949.

A magnetic survey was made with a Schmidt-type Askania approximately two months before the June 1944 eruption and two months after the upheaval of the ground at the eastern foot of the volcano. Measurements of the relative intensity of the vertical component were made at 100 stations over a 7-kilometer distance along a north to south road. The magnetic profile showed positive anomalies in the upheaval areas, and a sharp negative in a mineral spring zone. It is concluded that basic rock such as the somma lava, which lies at a depth of 120 meters, was elevated by active magma.—*M. C. R.*

12368. **Ferraz de Carvalho, Anselmo.** Estudos de geologia e de geofisica [Studies in geology and geophysics], 143 pp., Coimbra Univ. Pub., 1950.

This is a collection of articles and lectures on geological, meteorological, and geophysical subjects. Included are an analysis of modern conceptions and hypotheses of volcanism in connection with different geodynamic phenomena, especially of orogenic nature; the variations of the gravity vector at any point of the earth's surface and of oceanic tides caused by the action of the moon and the sun; seismic phenomena and the methods of their investigation; terrestrial magnetism, methods of studying geomagnetic phenomena, and periodic and spontaneous variations of geomagnetic field. Tables of annual means of geomagnetic vectors, as determined at the Geophysical Institute of the University of Coimbra for the years 1878–1925 and at the observatory of Lisbon for 1858–1898 are also given.—*S. T. V.*

SEISMOLOGY

12369. **Roberts, E. B. and Ulrich, F. P.** Seismological activities of the U. S. Coast and Geodetic Survey in 1948: Seismol. Soc. America Bull., v. 40, no. 3, pp. 195–216, 1950.

Activities of the Bureau during 1948 are summarized. Included are tables of 43 earthquakes in western United States of intensity 5 or greater on the Mercalli scale; isoseismal maps of the earthquakes of March 11 in northwest Texas, December 4 in southern California, and December 29 in western Nevada; a list of strong-motion records; tiltgrams from Long Beach and Berkeley; and a seismic probability map for the United States.—*M. C. R.*

12370. **Macelwane, J. B.** Jesuit Seismological Association Twenty-fifth Anniversary Commemorative Volume, 347 pp., St. Louis, 1950.

This volume is divided into three parts: the first, a sketch of the history of the Association and its Central Station; the second, a series of chapters describing each of the seismological stations or observatories that have at any time been members of the Jesuit Seismological Service or the Jesuit Seismological Association; and the third, a list of publications by personnel at any time connected with the Jesuit Seismological Association or its member stations.—*N. A. S.*

12371. **Agarwala, K. S.** Studies in seismology in the India Meteorological Department: Jour. Sci. Ind. Research, v. 9, no. 4, pp. 116–118, 1950.

The activities of the India Meteorological Department during the past forty years are reviewed. At present, seismological observatories are maintained at

Colāba, Calcutta, Delhi, and Kodaikānal, and an experimental station at Poona, chiefly devoted to the design and improvement of instruments. These observatories are equipped with Milne-Shaw seismographs, supplemented by Omori-Ewing instruments and several high-magnification Wood-Anderson seismographs. Plans are being made for setting up a first-class seismological observatory at Shillong which is in a region of intense seismic activity.—*S. T. V.*

12372. Broggi, J. A. Ciclo de conferencias sobre sismología [A course of lectures on seismology]: Peru Soc. Ing., Inf. y Mem., v. 51, no. 6, pp. 344–347, 1950.

The Escuela Nacional de Ingenieros has included a course of lectures on seismology in its curriculum. The program includes fundamental knowledge of earthquakes; theory of seismometers and other instruments used in the study of earthquakes; the effect of seismic shocks on different structures; seismic methods of exploration for minerals and for investigation of dam sites.—*S. T. V.*

12373. Savarenskiĭ, E. F., and Kirnos, D. P. The elements of seismology and seismometry [in Russian], 344 pp., Gostekhizdat, 1949. (From the review by E. A. Koridalin in Sov. Kniga, no. 10, pp. 38–41, 1950.)

The book is written in two parts, the first by Savarenskiĭ, on the theory of the propagation of elastic waves through the earth and the methods of interpretation of seismic observations; the second by Kirnos, on the organization of seismological observations and the theory of instruments.—*S. T. V.*

12374. Valle, P. E. Contributo allo studio delle onde di Love [Contribution to the study of Love waves]: Annali Geofis., v. 3, no. 2, pp. 231–250, 1950.

By calculating the spectral distribution of the energy associated with a non-monochromatic Love wave, it is possible to evaluate the intensity at the surface per unit of energy, as a function of the frequency of the wave.

It is found that the energy shows a maximum for a certain value of the frequency, which decreases as the thickness of the overlying layer increases. At frequencies higher than those corresponding to this maximum, the energy decreases rapidly to zero; at lower frequencies, the energy decreases slowly to a finite value. The effect of the dissipation of energy is to reduce rapidly the intensity of high frequencies, thus decreasing, in general, the predominant frequency as the distance increases.

The passage of Love waves from one layer to another causes a redistribution of the spectrum of the intensity at the surface. When the wave passes to a thicker layer, lower frequencies are amplified and the higher frequencies are reduced. The reverse takes place in the transition to a thinner layer. (*See also* Geophys. Abstract 12173.)—*S. T. V.*

12375. Gassmann, Fritz, and Weber, Max. Krystallbeschleunigungswesser des Institut für Geophysik der ETH [The crystal accelerometer of the Institute for Geophysics of the Federal Technical High School]: Schweizer. naturf. Gesell. Verh., 129 Versammlung, pp. 105–107, 1949.

An accelerometer for use in studying industrial vibrations and in seismic surveys has been developed and constructed by the Institut für Geophysik in Zürich. The principal element is a crystal of Rochelle (Seignette) salt which generates an electromotive force under the bending action of inertia forces caused by the acceleration to which it is exposed. This electromotive force is amplified and measured by an indicator consisting of a similar crystal sensible to torsion provided with a minute mirror, making it possible to record the vibrations photographically.

The sensitivity of the instrument may be as high as 0.05 mm./sec.^{2} per 1 mm. of the scale. In the frequency range of 1 to 400 c.p.s. the error of the reading is less than 1 percent and the phase displacement is less than 6°. The magnification is 8×10^4 for 10 c.p.s. and 8×10^6 for 100 c.p.s. The speed of the recording paper may be as much as 3 m./sec.

The equipment has been repeatedly tested in the field, in measuring vibrations of the buildings, paved streets, bridges, and in seismic investigations of dam sites and similar applications.—*S. T. V.*

12376. Sulkowski, E. I. The University of Pittsburgh pen-and-ink recording seismograph: Seismol. Soc. America Bull., v. 40, no. 3, pp. 165–168, 1950.

A system for pen-and-ink recording of the output of a seismometer, such as the Wenner, is described. The light beam is reflected from the galvanometer to an R. C. A. 1P21 phototube placed horizontally in the path of the reflection. A General Electric type C. E. photoelectric recorder is used to transform the output of the 1P21 tube into pen-and-ink recording. Standard recording drums may be used.—*M. C. R.*

12377. Volk, J. A. The photoelectric seismograph: Seismol. Soc. America Bull., v. 40, no. 3, pp. 169–173, 1950.

A visual-recording seismograph, using a photoelectric cell in conjunction with the standard photographic method, has been developed at St. Louis University. A standard 6-volt exciter lamp is used as a light source and the light beam is focused in a V-shaped light wedge after being reflected from the galvanometer mirror. The modulated light beam is received by a type 918 photoelectric cell. Pulses from the photoelectric cell are amplified by means of a standard AF amplifier with linear response from 100 to 1,000 c.p.s. Type 5693 and 6F6 tubes in pentode connection are used in a resistance-coupled amplifier to provide sufficient gain and output, after rectification by a germanium crystal, to drive a standard 0–5 MA ink recorder.—*M. C. R.*

12378. Nasu, Nobuji. Strong motion vibrograph: Tokyo Univ. Earthquake Research Inst. Bull., v. 25, pts. 1–4, pp. 57–60, 1947.

A three-component mechanical seismograph has been designed for measuring strong vibrations such as those of bridges or railway banks resulting from the passage of trains. Horizontal components are inverted pendulums. The movable part of the vertical component is suspended by a pair of helical springs, the lower ends of which are hooked to the pendulum bob. Periods of all components are 0.4 second, and air damping is used. Magnification is seven.—*M. C. R.*

12379. Ikegami, Ryohei. A nomogram for magnification of seismometer: Tokyo Univ. Earthquake Research Inst. Bull., v. 26, pts. 1–4, pp. 55–56, 1948.

A nomogram is given for determination of true amplitude of ground motion when the constants of the seismometer and recorded amplitude and period are known.—*M. C. R.*

12380. Volk, J. A. Microseismic arc light timer: Electronics, v. 23, no. 5, pp. 190–196, 1950. St. Louis Univ. Inst. Technology Pub. no. 45.

A timing marker which makes use of an arc light tube in conjunction with the usual tuning-fork oscillator is described. A circuit diagram is given.—*M. C. R.*

12381. Röthlisberger, Hans. Messung der Geschwindigkeit elastischer Wellen in Sandstein [Measurement of the velocity of elastic waves in sandstone]: Schweizer. naturf. Gesell. Verh., 129 Versammlung, pp. 107–109, 1949.

The velocity of propagation of seismic waves in different rocks of the Swiss Alps was measured using the accelerometer designed by the Institut für Geophysik. (*See* Geophys. Abstract 12375.) At the same time elastic properties and densities were measured in a laboratory.

In the field, explosions of about 40 kg. gum dynamite were electrically produced and recorded. The time of arrival of the first wave was determined at distances greater than 5 meters from the shot point. The accuracy of time recording was about 0.1 millisecond. Determinations of the velocity were made in sandstones that varied slightly in water content, color and other properties. Velocities in general ranged from 2.0 to 2.5 km./sec. with a velocity of 3.075 km./sec. in one place. Where it was possible to determine the time of arrival of the transverse wave, Poisson's ratio was found to be 0.258±0.005.

In the laboratory, the measurements were made on sandstone samples of 4 x 4 x 80 cm., which were excited to vibrations after they had been clamped in a vise at one end. The computed values of the velocity were always lower than those found in the field even though corrections for three dimensional stress conditions were taken into account. The causes of these discrepancies are not clear.—*S. T. V.*

12382. West, S. S. Dependence of seismic wave velocity upon depth and lithology: Geophysics, v. 15, no. 4, pp. 653–662, 1950.

Relatively pure clastic sediments have interval velocities given quite closely by the general formula $v=v_0\ (1+cz/v_0^4)$, where v_0 is a constant characteristic of the rock and c is 3.3 km.^{3}/sec^4. From this equation can be determined a function $v^4=9.5\ cz$ which defines the minimum possible velocity at a given depth and the maximum depth at which a given velocity can occur. An upper limit of velocity is given by data on limestones and by refraction measurements from 8 to 50 km. The limiting curves converge near 150 km. depth toward the function $v^5=180z$ which holds from 200 km. to the boundary of the core at 2,900 km.

It is suggested that velocity increases with decrease of porosity. The lower limit of velocity may correspond to the maximum porosity permitted by a given overburden and the upper limit is the velocity attained at zero porosity. Abnormal velocity functions may indicate a change of grain size in the sediments with depth and thus give a clue to migrations of ancient shorelines.—*M. C. R.*

12383. Kanai, Kiyoshi. On the existence of the M_2 waves in actual seismic disturbance: Tokyo Univ. Earthquake Research Inst. Bull., v. 26, pts. 1–4, pp. 57–60, 1948.

To confirm the existence of M_2 waves (Rayleigh waves along the boundary between the layer and subjacent medium), seismograms of two shallow earthquakes were analyzed. A phase was identified with minimum group velocity and period in close agreement with those predicted by theory.—*M. C. R.*

12384. Caloi, Pietro, Marcelli, L., and Pannocchia, G. Ancora sulla velocità de propagazione delle onde superficiali per tragitti subatlantici. Tentativo di prospezione profonda del bacino Atlantico, mediante le curve di dispersione delle onde L_Q [Further note on the velocity of surface waves through sub-Atlantic paths. An attempted exploration of Atlantic basin deeps using the dispersion curve of L_Q waves]: Annali Geofis., v. 3, no. 2, pp. 215–222, 1950.

Additional evidence is presented to support the conclusion that the Atlantic basin, at least in its north-central part, is, with respect to the propagation of surface waves, identical with the Pacific basin. A tentative determination of the thickness of the upper layer under the Atlantic Ocean is made on the basis of the dispersion curve of L_Q waves. If the granitic layer is assumed to be absent or of negligible thickness, the thickness of this layer is about 17 km., of the same order as the similar layer under the Pacific Ocean.—*S. T. V.*

12385. Peronaci, Francesco. Determinazione del valore medio dello spessore dello strato di granito per i tragitti Turkestan-Europa [Determination of the average thickness of the granitic layer between Turkestan and Europe]: Annali Geofis., v. 3, no. 3, pp. 407–410, 1950.

From the dispersion of Love waves on the seismograms recorded at eight European observatories for the violent earthquake of November 2, 1946, the average thickness of the granitic layer over the Turkestan-Europe path was found to be 18 km.—*S. T. V.*

12386. Schulze, G. A., and Förtsch, Otto. Die seismischen Beobachtungen bei der Sprengung auf Helgoland am 18 April 1947 zur Erforschung des tieferen Untergrundes [Seismic observations during the explosion on Helgoland on April 18, 1947 for the exploration of the crust]: Geol. Jahrb., Band 64, pp. 205–242, 1950.

Seismic observations of the Helgoland explosion were made at the Leipzig, Jena, and Stuttgart observatories, and at 24 seismic stations, along three profiles south, south-east, and north-east from the source. The velocities of $\overline{P}$ and $\overline{S}$ were 5.40 km./sec. and 2.94 km./sec. indicating a Poisson's ratio of 0.288. The thickness of this layer is 6.0 ± 1.0 km. The travel time curves of $\overline{P}$ and $\overline{S}$ are straight lines.

The P^* wave appears on seismograms of stations at distances greater than 107 km. The velocity for the first 200 km. is 6.18 km./sec., and then suddenly increases to 6.6 km./sec. The depth of the P^* layer is 9.3 ± 1.5 km. The velocities of S^* are 3.67 km./sec. and 3.87 km./sec., and Poisson's ratios are 0.228 and 0.238.

At all stations in northwestern Germany, the P_n velocity was 9.32 km./sec. but beyond this region the velocity was 8.14 km./sec. This decrease may be the effect of an inclined boundary surface of the peridotite layer, but gravity measurements contradict this assumption. The S_n velocity is 4.38 km./sec., and Poisson's ratio is 0.283.—*S. T. V.*

12387. Tuve, M. A., Goranson, R. W., Greig, J. W., and Rooney, W. J. Progress report on studies of deep crustal layers by explosive shots: Union géod. géophys. internat., Sec. Séismologie, Travaux sci., Ser. A, fasc. 17, pp. 5–6, 1950.

A preliminary report on the program of the Carnegie Institution of Washington. (*See also* Geophys. Abstract 11098.)—*M. C. R.*

12388. Dobrin, M. B. Submarine geology of Bikini Lagoon as indicated by dispersion of water-borne explosion waves: Geol. Soc. America Bull., v. 61, no. 10, pp. 1091–1118, 1950.

The normal-mode theory of Pekeris has been applied to water-wave dispersion recorded from the seismic-refraction survey of Bikini Lagoon. Investigations of water waves of 50 c.p.s. and higher, in the lagoon within 1-2 miles of reefs, give results compatible with normal-mode predictions for a liquid bottom and with refraction indications. The data show a speed of 1.05 times that of water within 20 feet of the bottom increasing to 1.3 at a depth of about 40 feet. Results of shots farther from the lagoon edge indicate speeds in the bottom much higher than shown by the refraction data. Dispersion patterns from shots in the central part of the lagoon show a discrepancy with the Pekeris theory that is attributed to a lateral variation in sedimentary composition between the edge and center of the lagoon. The Airy waves give information on the structure of the bottom to a depth of about 400 feet. Their group velocity and frequency are as predicted by the Pekeris theory for a bottom velocity of 6,500 ft./sec., which was found in the refraction studies. The fact that the Airy waves agree with the theory and the high-frequency waves do not, for data from shots near the lagoon center, suggests that the lateral change in type of sediment disappears within a depth of 100 feet.—*J. L. M.*

12389. Murphy, L. M. United States Earthquakes 1947: U. S. Coast and Geodetic Survey Serial No. 730, 62 pp., 1950.

This publication summarizes earthquake activity in the United States and regions under its jurisdiction in 1947. Included are noninstrumental reports (felt reports) of 223 earthquakes in the United States, Alaska, the Hawaiian Islands, Panama Canal Zone, and Puerto Rico, a summary of instrumental epicenters for 1945 of earthquakes recorded in the United States, epicenters of the principal earthquakes of the world during 1947, and analyses of strong-motion records. The most severe shocks in the United States in 1947 were those of November 23 in southwestern Montana (intensity 8), April 10 in southern California Manix fault (intensity 7), and October 16 southwest of Fairbanks (intensity 8).—*M. C. R.*

12390. Krinitzsky, E. L. Geological investigation of faulting in the lower Mississippi Valley: U. S. Waterways Experiment Station, Tech. Mem. 3-311, 89 pp., 1950.

The lower Mississippi Valley is a region of not infrequent earthquakes resulting from faulting in the bedrock underlying the Recent alluvium. Between 1915 and 1931, 25 shocks were recorded that centered in Missouri, 16 in Arkansas, and several more in Illinois, Tennessee, Kentucky, and Mississippi. Since October 1909, when the St. Louis seismological station was established, some 30 earthquakes have been observed in the lower Mississippi Valley.

Engineering structures in most of this region may be designed without particular reference to possible future faulting, but when an important structure is to be built in a known or suspected fault area, foundation conditions should be studied with the idea that special earthquake-resistant features may be necessary in the design.—*S. T. V.*

12391. Tercedor, Mariano. Estudio sismotectonico de la vega Granadina [Seismotectonic investigation of lowland of Granada]: Rev. Geofís., v. 9, no. 34, pp. 189–209, 1950.

The seismicity of Andalusia is studied on the basis of seismologic data of 300 earthquakes between 1908 and 1947 recorded at the Osservatorio Geofisico de Cartuja. The following conclusions were reached: because of the lower strength of the upper layer of Quarternary alluvium, shocks propagating through it are not as violent as those in surrounding Miocene strata; tectonic fractures below the Granada lowland extend to a depth of only a few kilometers; along and near the seismotectonically important line that runs across the province along the Río Genil are found the centers of all precisely located earthquakes; a pronounced fault line of probable seismotectonic importance can be established along the boundary of the Sierra Nevada, where gravimetric data indicate the separation of structures characterized by great differences in densities; numerous regularly occurring weak earthquakes suggest periodic readjustments of relatively small blocks accompanied by lesser liberations of energy.—*S. T. V.*

12392. Milosavlevič, R. A. Seismologic characteristics of the Jastrebac region [in Serbian]: Annales Géolog. peninsule Balkanique, tome 18, pp. 231–244, 1950.

Earthquakes in the region of the Jastrebac, an ancient crystalline mass surrounded by Cretaceous and Neogene sediments, are quite frequent but comparatively weak (intensity 6). Their epicenters form several pronounced seismogenic lines. The region is divided by a line crossing the mountain from west to east into two seismically different areas, a more stable southern half and a labile northern one. A map of the region is included.—*S. T. V.*

12393 Galanopulos, A. G. Die seismizität von Messenien [The seismicity of Messenia] [With summary in French]: Gerlands Beitr. Geophysik, Band 61, Heft, 3, pp. 144–162, 1950.

The seismicity of the southern part of Pelóponnisos has been studied on the basis of macroseismic observations collected since antiquity. Seismotectonic evidence indicates that Messenía is divided into two zones of different seismicity. One, bordered on the west and northwest by the Pliocene formations of the upper Elide, on the northeast and east by the valley of Alfiós and by the basin of Megalópolis, and on the south by the deep valley of Dervenion, is free of faults, and the intensities of earthquakes felt there never surpass degree 8 of the Rossi-Forel scale. The rest of Messenía frequently experiences violent earthquakes. Seismic observations confirm Philippson's hypothesis that this area is a typical plane of dislocation. The greatly dissected southern portion of Messenía bears evidence of extreme seismic activity in the past, contrasting with the stability of the mountainous massif of the north. Both the seismicity and the Pliocene downwarping and post-Pliocene rise of the Messenian peninsula decrease towards the south.—*S. T. V.*

12394. Gorshkov, G. P. Earthquakes in the territory of the Soviet Union [in Russian], 118 pp., Moscow, Geografgizdat, 1949. [From the summary by D. G. Panov in Vses. Geogr. Obsch Izv., tom 82, no. 4, 1950].

This is a geographic tabulation and a historical sketch of earthquakes occurring within the boundaries of the Soviet Union. An introductory chapter contains general information on the causes and the forms of seismic phenomena, methods and instruments for their study, and measurements of the intensity and the energy involved.—*S. T. V.*

12395. Masarskii, S. I. The epicentral zone of the aftershocks of the earthquake in Ashkhabad [in Russian]: Akad. Nauk SSSR Doklady, tom 74, no. 3, pp. 481–483, 1950.

The violent earthquake of October 6, 1948, in Turkestan was followed by a long series of aftershocks. For the precise observation of these aftershocks and for the study of tectonic details of the earthquake, additional instrumental equipment was set up in the nearest seismological observatory in Ashkhabad and five temporary seismic stations established in the area of 50 by 60 km. within degree 9 on the isoseismal map.

Observation of the aftershocks was extended until October 1949. The epicenters of the stronger aftershocks were determined, using Wadati's method, and the focal depths were computed, assuming the velocity of seismic waves in upper layers to be 3.2 km./sec.

The foci were found to lie at depths of not more than 15 km. and in two groups about 40 km. apart. The possibility is suggested that a deep rupture of this length was produced by the initial earthquake, and that the equilibrium is now slowly being restored.—*S. T. V.*

12396. Korn, H., and Martin, Hans. Erdbeben in Südwestafrika [Earthquakes in South-West Africa]: Geol. Rundschau, Band 38, Heft 1, pp. 19–23, 1950.

Data on the seismicity of South-West Africa collected by the Meteorological Institute of Windhoek include 435 observations of 223 earthquakes during the years 1911–1938. No instrumental records are available. The shocks were weak, only 23 reaching intensity 5 on the Mercalli scale, and only 8 causing damage to buildings. During one earthquake, that of October 10, 1925, a crack in the ground about 2 cm. wide and over 1 km. long was observed. Most of the earthquakes occurred in the Windhoek plateau in the elevated portions of the Damaraland, where on the average 8 earthquakes were observed annually. Most of the earthquakes were observed in the second half of the year, especially during August and September. This may be related to the decrease of barometric pressure during that time.—*S. T. V.*

12397. Nasu, Nobuji. Block movement along the seismic fault (1) (Fukui fault and others): Tokyo Univ. Earthquake Research Inst. Bull., v. 27, pts. 1–4, pp. 27–33, 1949.

The fault which was active during the Fukui earthquake was detected by precise triangulation surveys of the Geophysical Surveys Bureau. The fault terminates near the coast line of the Japan Sea and extends about 25 km. in a S. 20° E. direction in the northern part and S. 7° E. in the southern part. In general, there has been uplift on the eastern side and subsidence on the western. The horizontal shift along the fault has been estimated as 230 cm. in the northern part and 167 cm. in the southern. A resurvey a year after the earthquake indicates that the fault is still active.—*M. C. R.*

12398. Oulianoff, Nicolas. Commentaires géologiques des resultats du nivellement dans la region Sierre-Montana-Sion effectué à la suite du seisme du 25 janvier 1946 [Commentary on the results obtained from the leveling of the region Sierre-Montana-Sion, made as a result of the earthquake of January 25, 1946]: Schweizer. naturf. Gesell, Verh., pp. 103–105, 1949.

The valley of the Rhône between Sierre and Sion, which was the epicentral region of the earthquake of January 25, 1946, was surveyed with high precision in 1916, 1924, 1927, and 1947. Repeat leveling included the determination of the altitude of 59 bench marks. In many places the bench marks were initially set in unfavorable locations, as on alluvial terrain, and consequently now show subsidence not related to seismic effects. For bench marks placed on solid rocks, settlement ranging from 20 to 50 mm. were found, attributable directly to seismic shocks.—*S. T. V.*

12399. Sato, Yasuo. Possibility of optical explanation of visible wave motion of ground: Tokyo Univ. Earthquake Research Inst. Bull., v. 25, pts. 1–4, pp. 37–41, 1947.

A possible explanation of reported visible wave motion of the ground may be a change in the density of air and consequent curvature of optical path by compressional waves in the air resulting from vertical movement of the ground. Numerical examples indicate the effect is too small to be detected by the naked eye.—*M. C. R.*

12400. Omote, Syun'itiro. Earthquake damages in Yokohama City due to the great Kwanto earthquake of September 1, 1923: Tokyo Univ. Earthquake Research Inst. Bull., v. 27, pts. 1–4, pp. 57–62, 1949.

The numbers of totally destroyed wooden houses were used to prepare a map showing the degree of earthquake damage. The area in which damage exceeded 90 percent occupies a large part of the city.—*M. C. R.*

12401. Omote, Syun'itiro. The relation between the earthquake damages and the structure of ground in Yokohama: Tokyo Univ. Earthquake Research Inst. Bull., v. 27, pts. 1–4, pp. 63–68, 1949.

From a study of the relation between the destruction of wooden houses (*see* Geophys. Abstract 12400) and geologic structure, it was found that, with certain exceptions, the thickness of the uppermost layer of reclaimed soil is closely related to the amount of damage; that places underlain by thick alluvium experience serious damages, the damage rate increasing conspicuously as the thickness of alluvium exceeds 30 meters; and that damage is slight on sand spits or compacted sandy shores.—*M. C. R.*

12402. Sato, Yasuo. Relation between seismic intensity and epicentral distance: Tokyo Univ. Earthquake Research Inst. Bull., v. 26, pts. 1–4, pp. 91–93, 1948.

From studies of the felt reports of several earthquakes, a straight line formula $I=a+b\Delta$ was determined for the relationship between intensity and distance. The value of a ranges from 3.5 to 8.4, that of b from −0.71 to −1.40.—*M. C. R.*

12403. Ikegami, Ryohei. On the anomalous distribution of the maximum amplitude of earthquake motions: Tokyo Univ. Earthquake Research Inst. Bull., v. 26, pts. 1–4, pp. 83–89, 1948.

The distribution of maximum amplitudes of 91 earthquakes recorded at the principal stations in the Kwanto and Chubu [Chūbu-chihō] districts of Japan was investigated. In general the maximum amplitude decreases as the epicentral distances increase. Several anomalies, with too large or too small amplitudes regularly observed at certain stations, are attributed to the mechanism at the origin or to the geologic structure in the path of the waves.—*M. C. R.*

12404. Minakami, Takeshi and Sakuma, Shuzo. The earthquake motions on various formation of the earth's surface (I). Observation at Kōti City: Tokyo Univ. Earthquake Research Inst. Bull., v. 26, pts. 1–4, pp. 61–66, 1948.

Seismographs were set up at 14 stations on different formations in Kōti to record aftershocks from distances of more than 100 km. for a period of 26 days in March and April, 1947. Amplitudes were remarkably large on alluvial formations and motion lasted longer. Periods were longer on the alluvium and tended toward a fixed value. Amplitudes of nearby shocks, in which short periods predominate, were considerably reduced.—*M. C. R.*

12405. Sakuma, Shuzo. The earthquake motions on various formations of the earth's surface (II). Observations at Gobō and Kiribe: Tokyo Univ. Earthquake Research Inst. Bull., v. 26, pts. 1–4, pp. 67–73, 1948.

Observations of the aftershocks of the Nankai earthquake indicate that greater amplitude and longer periods are found on alluvium.—*M. C. R.*

12406. Valderrama Suárez, Mariano. Construcciones asísmicas [Earthquake-proof constructions]: Peru Soc. Ing., Inf. y Mem., v. 51, no. 6, pp. 339–341, 1950.

This is a brief discussion of the recommendations adopted by the Sixth Pan American Congress of Architects concerning structural precautions against damage caused by earthquakes.—*S. T. V.*

12407. Bernard, Pierre. Enregistrements microséismiques à Nantes [Microseimic recording at Nantes]: Annales Géophys., tome 6, no. 3, pp. 147–156, 1950.

The seismograms obtained at the new observatory of Petit-Port at Nantes during the first months of 1949 were analyzed and compared with those obtained at the old observatory of Saint-Maur. The Nantes observatory is erected on granite, that of Saint-Maur, on sedimentary rock. The periods of waves recorded on both seismograms were usually equal, but the amplitudes at Saint-Maur were regularly greater than those at Nantes, the ratio of the vertical amplitudes being 1.31 for waves of 5.3-second period, 1.13 for waves of 6.3-second period, 1.05 for waves of 6.9 second period, and 1.03 for longer waves of 7.5 second period. Ratios of the horizontal to vertical components, and of the north-south and east-west components at both stations in most of the observations agree with A. W. Lee's theoretical calculations. The maximum amplitudes of microseisms at Saint-Maur are associated with cyclones over Iceland and Faeroe Islands, but no such correlation was found at Nantes, perhaps because of the tectonic features of this basaltic region that are also indicated by magnetic anomalies.—*S. T. V.*

12408. Caloi, Pietro. Due caratteristici tipi di microsismi [Two characteristic types of microseismic disturbances]: Annali Geofis., v. 3, no. 3, pp. 303–314, 1950.

In the opinion of the author both coastal surfs and microbaric oscillations near the center of a cyclone can cause microseisms. Examples observed in the Adriatic Sea are cited. When cyclonic minima move across the northern part of the Adriatic Sea toward the Gulf of Trieste with a velocity characteristic of the propagation of free sea waves, they produce violent changes of the level in the gulf followed by the appearance of seiches. Later, when the cyclone reaches the gulf, seismographs begin to register microseismic disturbances with periods ranging from two to three seconds. The amplitudes of these microseismic waves gradually grow and attain maxima at the time of the sharp rise of barometric pressure. These microseisms are obviously produced by a combination of two phenomena—appearance of short period microbaric oscillations during the rapid rise of atmospheric pressure, and a sea level substantially below normal. This however, takes place only in the immediate vicinity of the coast.

A typical example of microseismic waves caused by the action of violent surf hitting the seashore was observed during the storm of January 23–27, 1950, along the coast of Catania when horizontal amplitudes up to 60 microns and vertical amplitudes up to 40 microns were registered. At the same time no microseismic waves were registered at Messina, only 85 km. from Catania. This suggests the existence of a geologic discontinuity between the two locations that may be attributed to the volcanic action of Monte Etna.—*S. T. V.*

12409. d'Henry, G. Sulla natura fisica dei microsismi [The physical nature of microseisms]: Annali Geofis., v. 3, no. 1, pp. 87–94, 1950.

To investigate the possibility of determining the character of the microseisms from the analysis of three components of motion obtained at one station, disturbances originated from clearly localized cyclones with azimuths lying in the planes of the instrumental components were studied on the seismograms of the Rome and Trieste observatories. It is concluded that the behavior of the microseismic wave is completely irregular and does not show characteristic features of either Rayleigh or Love waves. This abnormality of the microseismic wave may be caused by successive reflections and refractions at discontinuities in the upper layer of the crust.—*S. T. V.*

12410. Giorgi, Maurizio, and Rosini, E. Sulla natura delle cause che generano i microsismi [The nature of the causes that generate microseisms]: Annali Geofis., v. 3, no. 2, pp. 173–213, 1950.

An investigation undertaken by the Istituto Nazionale di Geofisica in cooperation with the Servizio Meteorologico dell' Aeronautica Italiana of the relationship between microseismic phenomena and atmospheric disturbances is described.

The periods and amplitudes from hour to hour of about 50 microseism storms which occurred during the year 1949 were carefully determined and analyzed with relation to simultaneous cycles of meteorological changes, mostly in the Mediterranean, but often extending over the European continent. It is concluded that microseismic disturbances of periods varying from about two to six or even ten seconds are causally related to the appearance over open bodies of water of atmospheric nuclei characterized by a positive barometric tendency. These nuclei of increasing barometric pressure may be either stationary or moving. The ultimate cause of microseisms must be periodic impulses of barometric pressure generated by turbulence in the upper layers of the atmosphere. (*See* Geophys. Abstract 11515.)—*S. T. V.*

12411. Morelli, Carlo. Studio comparativo dei microsismi registrati a Roma ed a Trieste [Comparison of the microseisms registered at Rome and at Trieste]: Annali Geofis., v. 3, no. 1, pp. 77–85, 1950.

Comparison of the period and amplitude of microseisms recorded simultaneously at Rome and Trieste shows that microseisms originating at a distance are always greater at Rome, the ratio being as high as 2:1. This is attributed to the effect of the alluvial layer on which the Rome seismological station is built. Microseisms of about 3.5-second period are greatly increased by resonance. Microseisms originated by disturbances over the Mediterranean also produce much greater amplitude at Rome Observatory.—*S. T. V.*

ELECTRICITY

12412. Rikitake, Tsuneji. A method for studying the relations between the changes in geomagnetism and earth current: Tokyo Univ. Earthquake Research Inst. Bull., v. 25, pts. 1–4, pp. 9–13, 1947.

Anomalous changes in earth currents are known at times to precede earthquakes. However, the main changes in earth currents are due to variations in the magnetic field outside the earth, making it difficult to determine effects related to the earthquake itself. This paper presents a method of eliminating geomagnetic effects of external origin.

With the aid of the electromagnetic-field equations, an expression is derived for computing the electric field from values of electrical resistivity and the time rate of change of the magnetic field at the surface of the earth. The earth potential calculated by this method from magnetic data obtained during a solar eclipse was in good agreement with the observed potential. The method described should make it possible to obtain more information on the relation of changes in earth currents to earthquakes.—*R. G. H.*

12413. Norinder, Harald, and Salka, Oskars. The effect of geological discontinuities on artificial lightning discharges as studied in a model test arrangement: Arkiv för Geofysik, Band 1, Häfte 1, pp. 45–78, 1950.

In areas with varied geologic structure natural lightning strikes have been observed to concentrate in nests. This possible effect of geologic structure was confirmed by model experiments using electric sparks 75 and 170 cm. long striking a smooth, horizontal surface. Striking points were strongly concentrated at the edges of a vein of powdered iron ore embedded in sand; weaker concentrations were shown around clay veins, granite rocks, and horizontal strips of thin metal. Discharges from a negative electrode were much more poorly concentrated than those from a positive electrode. The paper includes charts of the striking-point distribution and of the electrical properties of the models, as well as high-speed photographs of the discharges and a brief explanation of the observed effects.—*D. F. B.*

12414. Tikhonov, A. N. Determination of electrical properties of deep strata of the earth's crust [in Russian]: Akad. Nauk SSSR Doklady, tom 73, no. 2, pp. 295–297, 1950.

A correlation between magnetic variations and telluric currents observed on the surface of the earth is derived on the basis of Maxwell's equations. In a simplified treatment, the earth's crust is assumed as a layer of finite electrical conductivity spread over a medium of perfect conductivity. The surface of the earth is assumed to be a plane and the vertical component of the electrical field very nearly vanishing on this plane. Two horizontal components of the electric field and the components of the magnetic field are known from observations. These conditions make it possible to write the basic Maxwell equations of the problem. The solution is a superposition of harmonic functions, from which it follows that for low frequencies the amplitude of the derivative of the magnetic variation is proportional to the intensity of the electrical field. For higher frequencies the amplitude of this derivative is a functon of the electrical intensity and its derivative. This relation produces a phase displacement determined by the electrical resistivity of the earth's crust. This equation makes it possible to draw conclusions about the electrical properties of deep layers of the crust from observed curves of variations of the magnetic and electrical field on the earth's surface.—*S. T. V.*

RADIOACTIVITY

12415. Aler, Bo. The efficiency of a scintillation counter for gamma rays: Arkiv för Fysik, Band 2, Häfte 3, p. 225, 1950.

The general properties of a scintillation counter for gamma rays, consisting of a RCA 1P21 photomultiplier and an organic scintillator, were described and a comparison was made with the Geiger-Müller counter. Different methods to eliminate the dark current were discussed. With a reasonable background of 200 pulses per minute it is possible to count 50–60 percent of the Compton electrons from Co^{60} gamma rays with a clear naphthalene crystal 2-centimeters thick. Using anthracene under the same conditions one can count about 90 percent of the Compton electrons.—*N. A. S.*

12416. Graf, T. Construction of a multiple gamma counter of high efficiency and short resolving time: Arkiv för Fysik, Band 2, Häfte 3, pp. 224–225, 1950.

By combining three different methods for increasing the efficiency of a Geiger-Müller counter for gamma rays, a new detector was constructed which has the the following advantages over a conventional brass counter: a higher efficiency, a shorter resolving time, a solid angle of nearly 4π for samples placed at the center of the multiple counter, and a distance function closely following the law of inverse squares.—*N. A. S.*

12417. Johansson, S. A. E. Some applications of scintillation counters: Arkiv för Fysik, Band 2, Häfte 3, p. 225, 1950.

Scintillation counters provide great counting speed, making it possible to use them for the determination of very intense radiation. The background of a counter, counting 10^7 particles per second, has been eliminated by concidence coupling of two photomultipliers. The size of the impulses obtained from a counter depends on the energy of the particles that penetrate into the crystal; this dependence can be used for determining the energy. Attempts have been made to measure the energy of alpha and gamma radiation from various sources in this way. Experiments have been conducted to find out the applicability of the scintillation counter in investigations of cosmic radiation.—*N. A. S.*

12418. Festa, C., and Santangelo, M. Sul decadimento del K^{40} [On the disintegration of K^{40}]: Annali Geofis., v. 3, no. 1, pp. 95–101, 1950.

Methods for the measurement of the decay constant of K^{40} and the results are critically analyzed with respect to their compatibility with basic geologic data. The most probable value of the decay constant λ_β for disintegration with simultaneous production of beta rays is $(0.50 \pm 0.03)/10^9$ years. The constant λ of the total decay is $(1.87 \pm 0.1)/10^9$ years. Recent experimental determinations of these constants by Graf, Ahrens and Evans, and Bleuler and Gabriel give an average value for λ of $(1.89 \pm 0.2)/10^9$ years.—*S. T. V.*

12419. Tatel, H. E. Argon ^{40} and the age of the earth: Jour. Geophys. Research, v. 55, no. 3, pp. 329–336, 1950.

Potassium in the earth's crust cannot account for argon^{40} in the atmosphere by a factor of perhaps ten, and it may thus be concluded that the argon^{40}, which appears to be of radiogenic origin and generated since the formation of the earth, originated from potassium within the earth's mantle. Estimates of the extent and time of this process are limited by a lack of knowledge of how much argon is entrapped within the earth. If there is none, then the argon, being in equilibrium with potassium, was produced in the last 1.5 billion years. If there has been entrapment, an age of 2.1 to 3.3 billion years would account for the atmospheric argon if only one-half to one-fourth respectively escaped. If it is assumed that the formation of the crust sealed off the interior and all argon generated subsequently has been entrapped, then the earth existed about 500 million years before the crust was formed.—*M. C. R.*

12420. Ippolito, Felice. Recenti dati sull età della terra [Recent data concerning the age of the earth]: Soc. Naturalisti Napoli Boll., v. 56, pp. 95–99, 1948.

A discussion of Holmes' and other recent methods of the determination of the age of the earth.—*S. T. V.*

12421. Coppens, René. Étude sur la radioactivité de quelques roches par la plaque photographique [Study of radioactivity of certain rocks by photographic method]: Soc. franç. minéralogie et cristallographie Bull., tome 73, no. 4–6, pp. 217–321, 1950.

Comparative tests of numerous specimens were made by photographic and other methods. The necessary experimental procedure is described in detail and several formulas are derived for determining the uranium and thorium content and the mixture of these elements.—*S. T. V.*

12422. Hée, Arlette. Recherches sur la radioactivité d'un granite des Vosges par la methode photographique [Investigation of the radioactivity of a granite from the Vosges by the photographic method]: Annales Géophys., tome 4, fasc. 3, pp. 242–252, 1948.

This is a detailed report of the experiments on a sample of granite to determine its radioactivity that were previously briefly described in the note to the

Academie des Sciences. (*See* Geophys. Abstract 11321.) The present article contains a detailed description of the procedure, reproductions of the photographs obtained, and analyses of the results. The examination of the traces of alpha particles on the photographs leads to the conclusion that the principal radioactive mass contained in the sample is uranium.—*S. T. V.*

12423. Hée, Arlette, Jarovoy, Michel, and Kleiber, Joseph. Etude des depôts actifs dus aux roches [Study of radioactive deposits present in rocks]: Annales Géophys., tome 6, fasc. 3, pp. 164–178, 1950.

In exploring the possibilities of the photographic method, experiments were made first with minerals containing only uranium, later with those containing thorium almost exclusively, and finally those containing uranium, actinium, and thorium. By using a more precise technique the numbers of disintegrated atoms of each of the active substances could be determined and certain quantitative results indicative of the radioactive contents obtained.—*S. T. V.*

HEAT

12424. Benfield, A. E. Heat flow below the oceans: Nature, v. 165, no. 4194, p. 445, 1950.

Pettersson found the geothermal gradient in ocean-bottom sediments to be about 42° C./km., a value he considers unexpectedly high. (*See* Geophys. Abstract 11781.) However, if the low thermal conductivity of included water (0.0013 cal./cm. sec. deg. C.) appreciably influences the conductivity of the sediments, this high gradient may actually represent a lower heat flow than is usually found on the continents.—*D. F. B.*

12425. Rikitake, Tsuneji. A note on the temperature distribution within the earth: Tokyo Univ. Earthquake Research Inst. Bull., v. 27, pts. 1–4, pp. 17–20, 1949.

On the basis of previous study, it has been concluded that conductivity increases discontinuously below 400 km. to the order of 10^{-2} e.m.u., the outer layer being almost nonconducting with a conductivity of only 10^{-15} e.m.u. near the surface. From this conductivity distribution, a temperature distribution is inferred by a method similar to Coster's. (*See* Geophys. Abstract 10079.) The best fit is $T=273+ax$ where $a=3$°K./km. and $x=$the depth.—*M. C. R.*

VOLCANOLOGY

12426. Jaggar, T. A. Steam-blast volcanic eruptions. (A study of Mount Pelée in Martinique as type volcano): Hawaiian Volcano Observatory, 4th Special Rept., 143 pp., 1949.

The report deals with the author's expedition to Martinique and St. Vincent in 1902 and comparison of the experiences of other investigators of "explosive" eruptions. The Hawaiian mechanism is reviewed with special reference to rifts, underground water, intrusion furnace, wedge rupture, and lowering of magma. These features of structure are applied to Martinique, St. Vincent, Kilauea, Tarawera Mountain, Sakura-jima, Katmai, Taal, and Tomboro to bring out the contrast in steam eruptions. For all volcanoes steam eruptions are believed to be resultant features of ground water and of collapse.

The Pelée disaster at St. Pierre May 8, 1902, which was followed by the extrusion of a dacite dome with spines and renewed activity in 1929, was observed for paroxysms of downblast. Structure sections are drawn to scale, and the structural reactions of intrusion, rifts, boiler, gas effervescence, heat, and timing are outlined; and their bearing on volcanism, in general, the zones of volcanism, and the reaction of magma is suggested. Steam blast is contended to be a climax of eruption in the water zone.

In the theoretical conclusions, the new approach (called Earth-core Volcanism) attempts to reconcile primitive moonlike earth volcanism to modern intrusive siliceous volcanism in contact with surface water. The author desires to stimulate experiment in earth exploration by physical testing and rock sampling under ocean basins. An extensive list of references is included.—*N. A. S.*

12427. Omer, G. C., Jr. Volcanic tremor (Pt. 2: The theory of volcanic tremor): Seismol. Soc. America Bull., v. 40, no. 3, pp. 175–194, 1950.

Volcanic tremor may originate in the vibration of laminae, composed of successive lava flows, ash beds, and magma intrusions, which are partly freed by differential tilting of the surface around a volcanic vent during an eruption. The force of magma ascending through a linear crack will buckle the laminae, freeing them near the surface, and the pulsation of the flowing magma then sets these partially free laminae into vibration. Approximate mechanical analyses have been made to determine the order of magnitude of the vibrational frequencies and relative amplitudes to be expected. In these analyses, the laminae were treated as vibrating bars, all damping terms were neglected, and the bars were regarded as rigidly clamped at one end, free at the end in contact with the magma column and perfectly free along the sides. This system of assumed bars may be set into longitudinal, flexural, or torsional nodes of vibration, but the weight of the evidence favors the longitudinal vibration as the best explanation of observed seismograms.—*M. C. R.*

12428. Coats, R. R. Volcanic activity in the Aleutian arc: U. S. Geol. Survey Bull. 974–B, pp. 35–47, 1950.

Of the 76 active or extinct major volcanoes recognized in the Aleutian arc, extending from Buldir Island on the west to Mount Spurr on the east, 36 have been active since 1760. When plotted against time, the activity of the arc shows some signs of periodicity, the intervals between maxima being multiples of 20 years. In this report the geographic positions and altitudes of all the known volcanoes are tabulated, together with all known eruptive activity between 1760 and 1948. The kind of activity that has characterized the arc is described briefly; a list of 17 calderas, 9 of them previously unmentioned in the literature, is given; and the relation of volcanism to the structure of the arc is reviewed.—*N. A. S.*

12429. Macdonald, G. A. and Orr, J. B. The 1949 summit eruption of Mauna Loa, Hawaii: U. S. Geol. Survey Bull. 974–A, pp. 1–31, 1950.

In beginning a new eruptive phase of Mauna Loa on January 6, 1949, lava broke out along a series of fissures extending part way across the summit caldera and a short distance down the southwest rift. Within 48 hours a flow that had advanced more than 6 miles down the western slope became inactive. Within 72 hours lava extrusion was entirely restricted to a short length of fissure at the foot of the southwest wall of the caldera where lava fountains as high as 800 feet built a large cone of pumice and fine cinder, with a small cone of coarse cinder and spatter in its crater. Quiet outflow continued until about the end of May. Except for the increase in the number of earthquakes during the month before the eruption, no definite premonitory pattern of earthquakes was recognized. For several days preceding the outbreak magnetic disturbances, possibly connected with magma movements, were observed near Honolulu, 190 miles away. The eruptive products, the bombing of lava flows, and the prediction of coming activity are discussed—*N. A. S.*

12430. Williams, Howel. Volcanoes of the Parícutin region, Mexico: U. S. Geol. Survey Bull. 965-B, pp. 165-274, 1950.

The oldest bedded rocks in the Parícutin region, the Zumpinito formation presumably of early Tertiary age, probably underlie Parícutin volcano at a shallow depth and are closely associated with coarse-grained gabbros of uncertain age. Following a long period of erosion, the post-Zumpinito volcanoes were built, presumably in late Pliocene or early Pleistocene time as they are considerably eroded. Since then different cones have discharged lavas of separate natures with no regular trend of differentiation as yet detected. Most of the young volcanoes are arranged without order, a few being parallel to the principal fissure zone at the new volcano, Parícutin. Parícutin's history, the petrography of the rocks of the region, and geologic maps of the area are presented.—*N. A. S.*

12431. Fries, Carl Jr., and Gutiérrez, Caledonio. Activity of Parícutin volcano from July 1 to December 31, 1949: Am. Geophys. Union Trans., v. 31, no. 5, pp. 732-740, 1950.

Eruptions from the crater continued to be extremely variable and activity seemed to be slightly less intense than during the preceding half year. The outward form of the cone did not change greatly. The elevation of the east peak remained unchanged at 2,774.2 meters above sea level, but the west peak rose nearly 17 meters through the accumulation of pyroclastic material. Lava continued to issue without interruption from the vent at the northeast base of the cone, and the old vent at the southwest base of the cone was active for a few days early in July. The flow from the northeast vent reached a maximum distance of 3,100 meters north and northwest at the end of December.—*M. C. R.*

12432. Petroeschevsky, W. A., and Klompé, Th. H. F. Het vulkanologisch onderzoek in Indonesië [Volcanological investigations in Indonesia]: Chronica Naturae, Deel 106, no. 5, pp. 187-206, 1950.

This is a brief review of the volcanological studies by the Koninklijke Natuurkundige Vereniging in Indonesië, prepared for its centenary celebration.

Numerous expeditions have been organized for topographic and morphologic studies, geophysical and chemical investigations, and purely volcanological observations of different volcanoes. Most of the craters have been precisely surveyed with photo-theodolites, maps were drawn, and detailed pictures of the craters were made from the air.

For seismological studies, the division now has 5 Wiechert seismographs, one Omori, one Milne, and several lighter instruments for field use. One recent acquisition is a tilt meter. Many magnetic measurements were made in the craters. Gravity changes caused by the movements of the magma were also measured. Chemical analyses of volcanic gases are made regularly, and temperature measurements as high as 1,000° C. are made in boreholes. The Society publishes the Bulletins of the East Indian Volcanological Survey.

The article contains four photographs of craters and volcanoes, several tables with data on eruptions and a list of active volcanoes in the region with classification of their types.—*S. T. V.*

12433. Minakami, Takeshi. Recent activities of volcano Usu: Tokyo Univ. Earthquake Research Inst. Bull., v. 25, pp. 65–69, and 71–75, 1947.

Activity of Usu-dake started with a series of severe earthquakes in December 1943 and January 1944 at the northwestern foot of the mountain. This was followed by a great number of extremely shallow shocks at the eastern end and, simultaneously, a rapid rise of ground reaching a maximum of 50 meters at the center. The first explosion occurred June 23, 1944, near the center of the rising area. Explosive eruptions ceased in December 1944 but the upheaval and earthquakes continued until fall 1945 and viscous lava rose in the crater without overflowing. On the basis of geodetic and seismometric studies it is concluded that the activity was caused by viscous juvenile lava at a depth of 1–3 km. intruded into the upper crust near the eastern foot of Usu-dake and finally extruded.—*M. C. R.*

TECTONOPHYSICS

12434. Andrée, Karl. Einige geologische Konsequenzen einer Erdentstehung auf kaltem Wege [Some geologic consequences of the formation of the earth by a cold process]: Forschungen u. Fortsch., Jahrg. 26, Heft 9–10, pp. 122–123, 1950.

A recent hypothesis proposes the formation of planets including the earth, as condensations of primeval cold nebula, thus denying any initial high heat content of the earth as a glowing, bright star. Stars are composed of light gases, those heavier than oxygen forming only one percent of the total mass of the sun, for example. The earth, however, is composed almost exclusively of substances heavier than oxygen. Almost the whole heat content of the earth is the result of radioactive disintegration and therefore, no shrinkage of the earth owing to cooling ever took place. This corollary of the hypothesis radically changes the old conceptions of orogeny and emphasizes the geotectonic consequences of primordial inhomogeneities of the earth's mass which resulted, in the extreme, in the separation of the moon.—*S. T. V.*

12435. Goguel, Jean. Les déplacements séculaires du pôle [The secular displacements of the pole]: Annales Géophys., tome 6, fasc. 3, pp. 139–146, 1950.

Many circulatory movements in the atmosphere, in the oceans, and in the earth's interior, have a total kinetic moment, which is not zero because of the unsymmetrical shape of continents. From analysis of these different phenomena, the conclusion is reached that a slow secular displacement of the pole may have occurred, of the order of 25 km. per million years. In about 400 million years since the beginning of the Paleozoic era, this displacement would amount to one-quarter of the meridian, if the forces always acted in the same direction.

In reality, changes in the direction of ocean currents as well as of atmospheric currents have certainly modified the direction of this displacement. Rapid displacements of the pole over important lengths are quite improbable.—*S. T. V.*

12436. Leiviskä, Iivari. Kallioperän murtumat maanjäristykset ja jääkautiset tapahtumat [Breaks, earthquakes and processes of the glacial age in their influence on the structure of rocks]: Terra, v. 59, no. 1, pp. 9–13, 1947.

The broken topography of the Finnish terrain, especially noticeable on the shore lines of inland lakes and on the southwestern coast of the country, which is cut by numerous inlets and bays, is caused by the faults that occurred at different times. According to Sederholm's theory, these faults are the results of earthquakes which occurred during and after the glacial period. Leiviskä believes the earthquakes of the present time are not related to the faults which occurred much earlier in the glacial period. At the present time earthquakes are noticeable in the central portion of the Fennoscandian uplift which extends in a northeasterly direction across the northern part of the Gulf of Bothnia. The earthquakes of recent times must be causally related to the continental uplift whose central portion trends in the same direction as the ancient fault.—*S. T. V.*

12437. Noetzlin, J. Bilans énergetiques en géophysique [Balances of energy in geophysics]: 62 pp., Actualitiés scientifiques et industrielles, no. 1038, Paris, 1948.

From detailed calculations of the amount of heat produced by different radioactive substances contained in the earth's crust, and critical analysis of relative data given by different scientists, it is concluded that these amounts were and are the dominating terms in total heat balance of the earth. Orogenic phenomena as well as volcanism are the results of slight local disturbances of thermal equilibrium, an excess of locally produced heat over that dissipated. As a result, a local rise of temperature takes place near the surface of the earth, or deeper in the crust, causing the folding of external layers or the local accumulation of fluid magma below the crust with subsequent possibility either of volcanic eruptions or rising of regional blocks.—*S. T. V.*

INTERNAL CONSTITUTION

12438. Bonchkovskii, V. F. Soviet science on the structure of the earth [in Russian]: Nauka i zhizn', no. 8, pp. 23–30, 1950.

This is a review of different hypotheses on the internal structure of the earth and a summary of the theory recently suggested by O. I͡U. Schmidt. According to this theory the planetary system including the earth was torn from galactic masses by solar attraction. These masses, numerous in the Milky Way, are not luminous, and therefore the earth and other planets of the solar system never had the high temperature peculiar to the sun. Subsequent development of this idea leads to the conclusion that the temperature of the earth's interior increases only to a depth of about 100 km., chiefly from heat development by radioactive disintegration of elements in the earth's crust. At greater depths the temperature remains constant, but the pressure continuously increases. This combination of physical conditions brings about a decrease in the temperature of fusion of different minerals precipitated at various depths and causes the stratification of the earth with formation of interlying liquid strata. Related seismologic evidence, especially the peculiar decreases of seismic velocity with depth, and the tidal effect of the sun and the moon on the solid and plastic masses of the earth are discussed and found to be in agreement with the theory.—*S. T. V.*

EXPLORATION GEOPHYSICS

GENERAL

12439. Fabiani, Ramiro. Problemi e metodi della ricerca petrolifera [Problems and methods of petroleum exploration]: La ricerca sci., v. 20, no. 8–9, pp. 1069–1094, 1950.

The origin of petroleum and the geologic conditions necessary for its preservation are discussed. In the second section the principles of the various geophysical methods, gravimetric, magnetic, electric, seismic, and radioactive, are analyzed, and practical applications of these methods are described, mostly by examples of American practices.—*S. T. V.*

12440. Taborda, B. A. A puntes sobre exploración geologica del petroleo [Remarks on geologic exploration for petroleum]: Dyna, no. 61, pp. 49–65, 1949.

The organization of a geological and geophysical survey for oil exploration including expenses, qualifications of personnel, organization of transport facilities, and selection of the instruments and equipment, are discussed.—*S. T. V.*

12441. Brasil Conselho nacional de petroleo. Relatorio de 1948 [Report for the year 1948], 154 pp., Rio de Janeiro, 1949.

Extensive geophysical exploration is being conducted chiefly in the states of Pará, Sergipe, and Bahia. Seismic refraction surveys of about 60,000 sq. km. were made along the Rio Corda, and the reflexion method was used in the Ilha de Marajó where 1,678 profiles were investigated. A gravimetric survey with 3,963 stations occupied was also made in the latter region. A magnetic survey was made in the Amazon valley. Other regions which were explored seismically were the central portion of the Estado de Sergipe and certain regions of the Estado da Bahia. Results of these surveys are presented as maps and profiles.—*S. T. V.*

12442. Dessau, G. Some results of geophysical prospecting conducted for the Geological Survey of India from 1945–1948: Geophysics, v. 15, no. 4, pp. 704–731, 1950.

Geophysical investigations conducted by the Geophysical Section of the Geological Survey of India are described. Included were magnetic surveys for iron-ore deposits near Daltonganj in Bihār Province, and for manganese deposits in the Central Provinces; spontaneous-polarization surveys for pyrite in the Son valley and for graphite at Dandatapa; electrical-resistivity and seismic-refraction surveys in connection with engineering problems; and electrical-resistivity investigations in coal-bearing areas. (*See also* Geophys. Abstract 12443.)—*M. C. R.*

12443. West, W. D. General report of the Geological Survey of India for the year 1948: India Geol. Survey, Records, v. 82, pt. 1, pp. 1–253, 1950.

Among the investigations of the geophysical section briefly described are the electrical-resistivity investigations in the Kamptee area, near the city of Nāgpur, to determine the boundary, which is everywhere covered by alluvium, between the possible coal-bearing formations and the surrounding Archean non-coal-bearing rocks. Determinations of depths to bedrock by both seismic and electrical-resistivity methods were made around the Manas railway bridge that has been dislocated by floods, and the results obtained by the two methods agreed fairly well. Similar surveys were also made in the Bombay Presidency to determine the depth to bedrock for bridge foundations. Investigations for manganese ore by the magnetic method were made in the Central Provinces. Horizonal magnetometer readings were made at more than 3,000 stations in an area of about ¾ sq. km. This survey was supplemented by electrical-resistivity and spontaneous-polarization measurements. The results indicate that although concordant results were obtained by the resistivity work, the magnetic method is the more suitable. A spontaneous-polarization survey for graphite deposits was made near Dandatapa, Athmallik, Orissa, with about 3,000 stations occupied over an area of about 0.6 sq. km. The results of prospecting for ground water by resistivity method in highly arid regions in west Rajputana indicated that the water-bearing zone is extremely thin and probably does not form a continuous water table. Salinity of ground water made the geophysical surveying most difficult.—*S. T. V.*

12444. Hallenbach, Franz. Physikalische Gesteinsdaten, Bestimmung und Verwendung [Physical properties of rocks, their determination and use]: Erdol u. Tektonik in Nordwestdeutschland, pp. 308–314, 1949.

Studies of the physical properties of rocks by the Amt für Bodenforschung in cooperation with other institutions, both in the laboratory and in the field, are described. Magnetic susceptibility, specific gravity, porosity, permeability, and elastic properties were studied. Some correlations of porosity with the depth of the formation and of seismic vèlocities and geologic age of a formation were noted. Investigations of the permeability of rocks suggested important deviations from d'Arcy's law. A negative correlation between the electrical resistivity of a formation and its radioactivity was established.—*S. T. V.*

GRAVIMETRIC METHODS

12445. Olczak, Tadeusz. Pomiary wagą skrechén i problem wyznaczenia wyzszych pochodnych normalnych zewnętrznege potencjau siy ciężkosci [Measurements with the Eötvös torsion balance and the problem of determining the higher normal derivatives of the external gravity potential]: Poland Instyt. Geol. Biul., pp. 27–44, 1948.

A method of determining the first and second derivatives of the gravity force g with respect to the vertical coordinate is presented. The procedure is based on the results from the measurements made with the torsion balance if the stations are dense enough, and on relations deduced from the Laplace equation. Both derivatives may be used with advantage in gravitational prospecting because both these values decrease rapidly with increasing distance from the disturbing mass.—*S. T. V.*

12446. Smith, N. J. The case for gravity data from boreholes: Geophysics, v. 15, no. 4, pp. 605–636, 1950.

Applications, instrumental requirements, and problems of interpretation of borehole measurements of gravity are considered, the analysis being hypothetical and qualitative.

A gravity meter in a borehole is subject to the free-air effect, the Bouguer effect, and the anomalous value. The free-air effect accounts for a linear increase in gravity for increasing depths; the Bouguer effect accounts for gravity effects of horizontal layering; and that portion of the gravity reading not accounted for by the free-air and Bouguer effects is the anomaly.

The body causing an observational anomaly may often be determined by indirect calculations of the effects of assumed idealized bodies. The vertical gradient is more sensitive to factors of depth and shape than the vertical acceleration of gravity, but its determination is more dependent on the initial free-air and Bouguer corrections. By combining borehole data with auxiliary information and acceptable corrections a density function of depth may be determined.

As the ability of an interface to reflect seismic waves depends on density, the density function may be used to determine interfaces at which seismic reflections may be expected and whether the reflected wave will be of the same or opposite phase. If density and velocity curves are determinable with sufficient accuracy, amplitude values could be used for correlation of wave patterns, if adjustment can be made for instrumental performance, but such use requires accuracy in velocity determinations several times as great as currently available. Data could also be used in identifying and evaluating elastic constants of the various layers.

Gravity values determined in boreholes could be used to identify or eliminate such geological conditions, as those that are due to mineral composition, porosity, fluid quantity and fluid type. These, in turn, could be used in predicting values for electrical resistivity, thermal capacity, thermal conductivity, induration and compaction. As density is likely to remain constant within formations, a density-depth function could be used to locate formations.

The determination of gravity values by gravimeters in current use is limited by the requirements of leveling and reading at rest. Acceleration changes that are due to motion can be greater than those that are due to geologic anomalies. If two gravity meter elements could be fastened together, the two effects could be opposed to produce a gravity-gradient meter, which would furnish data for immediate plotting and also make possible readings during motion, as both elements would undergo identical accelerations caused by motion. It could also furnish continuous profiles and detect thinner layers. Smaller spacing of the elements has greater powers of layer discrimination when adequate density contrast is present but that larger spacing is better for thick layering with less density contrast. Also, large spacing would be less sensitive to hole diameters. The size of the borehole must also be considered. For small ratios of hole radius to layer thickness, the effect of the hole dies off rapidly with distance from the layer, and is small even at the layer itself. For beds thick enough to be detectable, a hole diameter of eighteen inches is not likely to be critical. The presence of mud or casing represents a constant term in the gravity measurements except near ends of the hole or casing or near collars. End effects become negligible at the order of three times the hole diameter, and the effects of collars can be anticipated. Density logs in cased holes could be better than those in uncased holes.—*I. R.*

12447. Hammer, Sigmund. Density determinations by underground gravity measurements: Geophysics, v. 15, no. 4, pp. 637–652, 1950.

To determine the densities of subsurface strata, gravity observations were made in a vertical shaft at Barberton, Ohio. Measurements were made with a standard-type small-size Gulf gravimeter at approximately 200-foot intervals from the surface to the floor of a mine at 2,246.6 feet. Density measurements of hand and core samples made in the laboratory for comparison showed great differences and a systematic tendency toward lower density values. No significant sources of systematic error were found in the gravimeter results, so it is concluded that the discrepancy between density determinations is probably to be attributed to drying or other changes associated with core drilling. It appears that density determinations of finite intervals of underground rock strata can be better made by the gravimeter than by laboratory measurements of rock samples.—*M. C. R.*

12448. Sellien, K. Ein Diagramm zur Bestimmung der Wirkung gegebener unregelmässig geformter Massen auf die Schwereintensität [A diagram for the determination of the effect of given irregularly shaped masses on the intensity of gravity]: Gerlands Beitr. Geophysik, Band 61, Heft 2, pp. 61–65, 1950.

A procedure is developed for the calculation of the gravitational effect, at a given point on the earth's surface, of buried masses of irregular shape. This procedure consists in the division of the cross section of the buried body into a combination of narrow strips, each having broken lines as its boundary with a vertical or even inclined plane of fracture, similar to a geological formation with a break in its middle. The same procedure is also applicable when the area under investigation contains stratified formations of different density. The proposed procedure saves time, and results in greater accuracy because, with the aid of once-calculated tables, only addition and subtraction are used.—*S. T. V.*

MAGNETIC METHODS

12449. Cook, K. L. Quantitative interpretation of vertical magnetic anomalies over veins: Geophysics, v. 15, no. 4, pp. 667–686, 1950.

From the formulas developed by Haalck, Heiland and others for special cases of the magnetic anomaly over tabular veins the general formula for the vertical-component magnetic anomaly over tabular veins has been derived as a function of the susceptibility, dimensions, shape, and disposition of the vein and of the strength and direction of the earth's field. Eight families of profiles of vertical magnetic intensity over veins have been plotted by varying one parameter while holding the others constant. These are: for vertical veins with infinite depth extent striking north, variation of depth to width ratio and of width; for vertical veins with finite depth extent striking north, variation of depth extent and of depth of cover; for infinite and finite veins striking north, variation in dip; for infinite and finite veins striking east, variation in dip.

The profiles are plotted in terms of a parametric unit so that those for vertical veins may be used repeatedly in different districts by choosing the proper factor as a multiplier for each curve.—*J. R. B.*

12450. Ingham, F. T. Iron: Federation of Malaya Geol. Survey Dept. Rept. for 1949, p. 25, 1950.

Anomalous behavior of compasses has been reported by pilots flying at 15,000 feet over the Gunong Benom, and the anomalies are stated to be somewhat more marked on the eastern side, near Tungku. It is possible the anomalies are due to the presence of iron-ore in a larger area and in larger deposits than is suggested by the scanty evidence noted on the ground.—*V. A. S.*

12451. Rayner, J. M. Preliminary geophysical report on the southern extension of the main line of lode, Broken Hill: New South Wales Geological Rept. 1939–1945, pp. 30–35, 1950.

An area of more than 1,400 acres containing several zinc ore bodies, some at a considerable depth, was surveyed in 1938–39 and later by magnetic and gravimetric methods. In the magnetic survey, two Askania field balances were used, and the probable error of a reading was ±4 gammas. The interval between traverses was 200 feet for the greater part of the survey, and the intervals between stations ranged from 25 to 50 feet. For the gravimetric survey, an Oertlings gradiometer with sensitivity of 2 Eötvös was used. Five traverses were made, the intervals between stations ranging from 200 to 500 feet. As a result of the geophysical surveys, a reversal in pitch of ore deposits was discovered, bringing them within readily mineable depths. Conclusions were checked and confirmed in many places by drilling.—*S. T. V.*

SEISMIC METHODS

12452. Haarstick, Fritz. Die Weg-Zeitkurve in der Reflexionsseismik [The path-time curve in the seismic reflection]: Geol. Jahrb., Band 64, pp. 173–185, 1950.

Northwestern Germany is a very unfavorable place for seismic prospecting because formations are of insignificant and of varied thicknesses, and rapidly varying elastic characteristics. The velocity of seismic waves ranges from 1,800 m./sec. in Tertiary rocks to 3,500 m./sec. in Triassic rocks. This necessitates the use of complicated methods of analysis if gross errors in interpretation of the results are to be avoided. A new procedure based on the relation between the advance of the wave front from any point in a formation and the corresponding time interval is suggested. This relation is represented by the "path-time" curve. The graphic procedure suggested is applicable to formations of constant and of varying thickness. As the method is based on the knowledge of the velocity of seismic waves through different formations, the necessity for more experiments for measuring these velocities in drill holes is emphasized.—*S. T. V.*

12453. Langhammer, A. Bemerkungen zu L. Krouskij: Über die Bestimmung des wahren einfallens und der wahren Tiefe reflexions seismisch ermittelter Schichten [Comments on L. Krouskij's paper: The determination of the true inclination and depth of layers from seismic reflection data]: Erdol u. Kohle, Jahr. 31, Heft 5, pp. 217–218, 1950.

Krouskij determines the slope of the reflecting layer and its depth below the shot point by using its image and protracting the seismic ray beyond the point of intersection. This operation represents an extrapolation and cannot be always applied. Several examples are given when it would give an erroneous result, and a slightly different procedure proposed.—*S. T. V.*

12454. Slotnick, M. M., Brooks, J. A., Jr., and Redding, V. L. Note on well-shooting data and linear increase of velocity: Geophysics, v. 15, no. 4, pp. 663–666, 1950.

A determination of v_0 and a in the equation for linear increase of velocity $v=v_0+ah$ may be made from three sets of well-shooting data, each set consisting of the horizontal distance from shot point to well head, depth, and travel time from shot point to that depth. For values of a of 0.5. 0.6, 0.7, 0.8, and 0.9 which cover the range known from experience, the corresponding value of v_0 is computed from the expression for the travel time and the results plotted. The average of the intersections is used as the value for v_0 and a.—*M. C. R.*

12455. Campbell, F. F. The Fort Cobb anticline: Geophysics, v. 15, no. 4, pp. 585–604, 1950.

The Fort Cobb area is southwestern Oklahoma has been explored seismically by Amerada Petroleum Corp. and Superior Oil Co. Despite differences in seismic techniques, structural interpretations were similar. Three dry holes have tested the structure to a depth of 17,800 feet. The limited amount of data from wells tends to confirm the seismic data. Copies of seismic records, cross sections, and structure maps on three horizons are shown.—*M. C. R.*

12456. Rummerfield, B. F. Algunos problemas de la exploración sismologica en México [Certain problems in seismological exploration in Mexico]: Asociación Mexicana Geologos Petroleros Bol., v. 2, no. 5, pp. 305–311, 1950.

Seismologic methods of exploration have been applied to less than 25 percent of the total area of Mexico allocated for such prospecting and in many places the exploration has not yet been completed. As elsewhere, difficulties in seismic exploration are caused by insufficient knowledge of seismic velocities in different formations. To this must be added, as typically Mexican, difficulties produced by intrusive bodies, possible refractions of reflected rays, the effect of fractures and faults, and the possible pressure of reefs. The greatest difficulty, typical of the petroleum regions of northern Tampico, is the presence of many intrusions, creating a complicated subterranean structure and resulting in unusual paths of seismic rays. Similar conditions are found in the region of Poza Rica, Veracruz, where extrusive rocks reach the surface. Unusual conditions were also found in investigating salt domes on Tehuantepec Isthmus, where differences in the porosities in several Cretaceous strata complicated the seismograms by causing additional reflections.—*S. T. V.*

12457. Krey. Theodore. Einige Beispiele reflexions seismischer Ergebnisse Nordwestdeutschlands [Examples of the results of seismic investigations by the reflection method in northwestern Germany]: Erdöl u. Tektonik in Nordwestdeutschland, pp. 285–292, 1949.

The areas which have been explored by the seismic method include a series of Permian salt deposits in western Holstein, the deep salt domes of the northern part of Hanover province, shallow salt domes in Lüneburger Heide, anticlines near the Dutch-German frontier, and the basin of Münster. The seismic profiles and the suggested geologic cross sections of these structures are presented and their correlation discussed.—*S. T. V.*

12458. Hertwig, August. Das technische Experiment in der Bodenmechanik [The place of technical experiments in soil mechanics]: Bautechnik-Archiv, Heft 3, pp. 72–74, 1949.

The dynamic method of soil exploration consists of the production of mechanical waves by special vibrators set on the ground and observation of these waves by seismographs suitably distributed. By using vibrators in drill holes it is possible to increase the range of the method. The vibrators are run with a constant frequency, which can be varied, and thus the critical frequency of the surrounding terrain can be determined. Presence of disturbing bodies underground can be easily detected, if their mechanical properties are different from those of the surrounding medium, by changes in the velocity of the waves.—*S. T. V.*

ELECTRICAL METHODS

12459. Huber, A. Zur theorie der geoelektrischen widerstandsmethoden [The theory of the geoelectric-resistivity methods]: Archiv für Meteorologie, Geophysik u. Bioklimatologie, Band 1, Heft 3–4, pp. 408–420, 1949.

A differential equation is derived for the potential field created by two electrodes placed on the earth's surface where the surface of the earth separates a medium of infinite electrical resistivity (air) from a nonhomogeneous one (ground) with its resistivity varying with the depth. An analysis is made of the boundaries of the region in which the nonhomogeneous field in the ground with assumed electrical properties can be replaced by a homogeneous one with an imposed limit of error which can be tolerated by such simplifying assumptions. In general, such regions will be found near the mid point between the two electrodes, where the lines of force run almost parallel. In other points of the medium the volume of the homogeneous field will be much reduced, but always available.

The method is also applied to a case of a buried cylinder, which produces an anomaly that serves as an indicator of its location. The treatment is purely theoretical.—*S. T. V.*

12460. Mukhina, G. V. The screening effect of conductive layers [in Russian]: Akad. Nauk SSSR Izv., Ser. geog. i geofiz., v. 14, no. 4, pp. 302–316, 1950.

Use of the electrical method of exploration is frequently impossible because of the presence of a conductive layer covering the soil. An approximate solution is derived for the electrical field at any point underground which is accurate for points lying deeper than three times the thickness of this upper layer. A more complicated case is treated when the underground is separated by a vertical plane into two domains with different electrical properties covered by a common conductive layer. The solution is given in the form of an integral equation, which can be solved by the method of successive approximations. This solution can also be extended to the case when the upper, conductive layer is also split into areas of different electrical resistivity.—*S. T. V.*

12461. Abelès, Florin. Recherches sur la propagation des ondes électromagnetiques sinusoïdales dans les milieux stratifiés [The propagation of sinusoidal electromagnetic waves in stratified media]: Annales physique, tome 5, pp. 596–640, 1950.

The study consists of two parts: development of the general theory of propagation of electromagnetic waves through stratified media, and special problems of the propagation of waves through homogeneous thin strata. The treatment is general, but the conclusions can be applied to problems of mechanical vibrations, thermal waves, and acoustical phenomena.

The author starts from Maxwell's equations for the field in a stratified medium, discusses linearly polarized waves represented by exponential functions with complex exponents, and establishes a system of differential equations of the first order for these waves. Modifications caused by discontinuities in the physical properties of different strata are analyzed and the coefficients of reflection and transmission of waves are determined. These general results are applied to the special cases of the presence of absorbing layers, a medium with symmetrical properties, the presence of a very thin intermediate layer, and layers with periodical variations of physical properties.—*S. T. V.*

12462. Belluigi, Arnoldo. The electromagnetic field due to induced currents in a conductive slab of finite dimensions: Geophysics, v. 15, no. 4, pp. 687–703, 1950.

The theory of the electromagnetic field for a thin, plane, conducting slab oriented perpendicular to the ground is developed. Solutions are given in the form of integral equations for the case of a finite slab (dike) energized by an inducing alternating magetic field. The extension of these formulas to include the case of a semi-infinite slab, or mineralized vein, results in the derivation of the Peters-Bardeen integral-resolving formulas. Subsequent integration yields expressions for the horizontal and vertical components of the magnetic flux density along a direction normal to the slab. The results are presented in the form of graphs of the components in phase with the inducing field plotted against horizontal distances from the plate, for various depths and vertical thicknesses of the slab. These solutions may prove useful for the interpretation of electromagnetic field profiles.—*I. Z.*

12463. Belluigi, Arnoldo. "Bicaram"—Nuova apparecchiatura elettromagnetica ["Bicaram"—A new electromagnetic apparatus]: Ufficio Geol. d'Italia Boll., v. 70, pp. 227–241, 1950.

An instrument has been designed and constructed for use in geophysical prospecting by the electromagnetic method to permit a convenient comparison of the intensities and phase relations of two magnetic alternating fields. It consists of two identical coils, with adjustable ohmic resistances and capacities connected to the extremities of each coil, and a zero indicator, as in a Wheatstone bridge, in a middle plane. Ordinarily, an earphone with an amplifier will serve as a zero indicator. The theory of the apparatus is developed and the different elements described. Instructions are given for its use.—*S. T. V.*

12464. Belluigi, Arnoldo. Su alcuni orientamenti teorici per le misure elettromagnetiche in galleria di miniera [Some theoretical considerations on electromagnetic measurements in mining galleries]: Riv. Geofis. Appl., v. 11, no. 1, pp. 15–25, 1950.

Intensity, phase displacement and other properties of the secondary electromagnetic field in a homogeneous isotropic ground are computed as functions of the frequency and coefficient of induction of the primary electromagnetic field. The investigated electromagnetic fields are produced and measured by special instruments designed for use in underground galleries when mining metallic ores that show sufficient contrasts in electric properties with the surrounding formations. The proposed measurements are to be applied when searching for electric anomalies in the underside walls or pillars of the galleries, assuming presence of buried ore bodies. Related formulas are given for the arrangements using electric dipoles or rectilinear emitters of finite length.—*S. T. V.*

12465. Whetton, J. T., and Myers, J. O. Application of electrical-resistivity measurements to the location of coal seams at shallow depth: Leeds Philos. Lit. Soc. Proc., v. 5, pt. 3, pp. 263–268, 1949.

An investigation was made to determine the value of electrical-resistivity methods in prospecting for coal seams at shallow depths. Suitable sites were selected where the topography was fairly level and where the seams had a shallow dip. Two sites were surveyed using an ordinary Megger earth tester and the single-electrode-probe method. The sensitivity of the instrument was such that a maximum depth penetration of 120 feet was secured.

The high resistivity of the coal seams may be considerably modified by the moisture content and by the mineralization of the underground water, reducing the contrast in resistivity between the various rocks.

Comparison of the resistivity results with the borehole logs shows that at one site a fair correlation exists between the depths of the coal seams indicated in the boreholes and the depths indicated in the probes, but in another area the method appears to have been more successful. Of 28 seams indicated in the boreholes, seventeen produce identifiable features on the curves.—*S. T. V.*

12466. Manfredini, Antonio. Studio geofisico della formazione gessososolfifera Siciliana con il metodo della resistivita elettrica [Geophysical investigation of gypso-sulfurous deposits in Sicily using electrical resistivity method]: Ufficio Geol. d'Italia, Boll., v. 70, pp. 243–246, 1950.

A survey for gypsum and sulfur was made of an area of about 8 sq. km. in Sicily during the summer of 1946 using the resistivity method with Wenner's configuration of electrodes and soundings to 200 meters depth. The satisfactory results of the investigations may be attributed to the great contrasts in resistivity ranging from 2.6 to 4.0 ohm-meters in sand; 11.0 to 16.0 ohm-meters in aluminites; and 41.0 to 70.0 ohm-meters in gypso-sulfurous layers.—*S. T. V.*

12467. Paver, G. L. The geophysical investigation of underground water supplies: a geological analysis of observed resistivity data: Jour. Inst. Water Eng., v. 4, no. 3, pp. 237–266, 1950.

Seventy-five electrical-resistivity surveys for water in Greece, Malta, Cyprus, Asia Minor, North Africa, Kenya, Somaliland, Tanganyika, and in South Africa are summarized. Direct current measurements with nonpolarizing porous-pot electrodes were mostly used, although commutated current measurements with a double commutator, producing a low frequency alternating current in the ground and direct current in the instrument circuit, were also used. This arrangement compensates for any earth currents and minimizes induction effects.

Typical examples of observed resistivity depth-probe curves, constant separation traverses, isoresistivity plans, and ratio-resistivity traverses form the basis for the discussion. All examples were verified by borehole data.

The geophysical data presented are divided into sections dealing with surveys over sedimentary, igneous, and metamorphic rocks, with further subdivisions based upon geologic age. Interpretation of the observed data is discussed in the light of the geologic mode of occurence of underground water in each case, as controlled by the particular geologic, topographic, and hydrologic factors involved. From the very beginning of geophysical measurements to their final interpretation in terms of underground water potentialities, geologic factors are emphasized as being of primary importance.

A basic knowledge of the theoretical implications involved is necessary for a proper evaluation of observed resistivity data, the resultant interpretation being dependent entirely on an understanding of geologic probabilities.—*S. T. V.*

12468. Cooper, W. G. G. Electrical aids in water finding: Nyasaland Geol. Survey Bull. No. 7, 23 pp., atlas [no date].

This paper briefly reviews the theory and practice of electrical-resistivity surveys for ground water in Nyasaland. The effects of electrochemical action and electrosmosis as well as of terrain and geologic structure on migration and collection of ground water and on natural earth potentials are also discussed. Several examples are given to show the author's method of tabulating and interpreting resistivity data.—*H. R. J.*

12469. Walters, R. C. S. Some geophysical experiences in water supply: Jour. Inst. Water Eng., v. 3, pp. 436–441, 1949.

The results of resistivity surveys at three ground water and one dam site in England are briefly summarized.—*D. F. B.*

12470. Cummings, J. B., and Romslo, T. M. Investigation of Twin Buttes Copper mines, Pima County, Ariz.: U. S. Bur. Mines Rept. Inv. 4732, 12 pp., 1950.

As part of a program of mapping, test pitting, trenching, and sampling, detailed natural-potential surveys were made in six selected areas. A few centers of electrochemical activity were found near old mine workings. Horizontal resistivity profiles at four depths were made along one traverse across a fault of igneous and sedimentary rocks in contact. Natural-potential maps and resistivity profiles are included.—*G. D. B.*

12471. Lundberg, Hans. Airborne electrical surveys for regional studies in oil and ore prospecting: Canadian Inst. Min. Metallurgy Trans., v. 53, pp. 130–132, 1950.

An airborne method of making induction electrical surveys is described. A many-turn loop wound around the fuselage of a plane is energized with a few amperes alternating current of less than 1,000 c. p. s. This induces alternating current of the same frequency in conductors below the path of the aircraft, which in turn sets up a secondary field whose amplitude and phase are detected and recorded in the airplane. The conductors (ore bodies or low-resistive sedimentary horizon) can be identified by a study of their secondary induced effects, and because the secondary field can be calculated for different induction factors and depths, it is possible to determine from the phase and amplitude records the depth below the aircraft of flat-lying conductors. In oil prospecting the conductivity of groups of formations may be used to determine the amplitude and phase of the secondary field, but for interpretation purposes it is possible to idealize these effects as having been caused by only three or four formations. Information on sedimentary structure at a maximum depth of 2,500 feet can be obtained from the records. The Quemont, a flat-lying highly conductive ore body, can be detected under 250 feet of overburden. Steep-dipping ore bodies and shear zones offering smaller target areas require extreme sensitivity of the equipment but can be located and identified by this method. Illustrations of test results are shown.—*W. J. D.*

WELL LOGGING

12472. Cervera del Castillo, E. Registro radioactivo en el nordeste de Mexico [Radioactive logging in northeastern Mexico]: Assoc. Mexicana Geologos Petroleros Bol., v. 2, no. 5, pp. 313–322, 1950.

After a brief explanation of the physical principles of radioactive well logging, a lithological interpretation is presented of the results obtained in different oil wells in northeastern Mexico during surveys made in 1945–47.—*S. T. V.*

12473. Thomeer, J. H. M. A. Radioactiviteit van sedimentgesteenten als hulpmiddel bij het onderzoek van aardolieboringen [Radioactivity of sedimentary rocks as an aid in the investigation of bore-holes in petroleum exploration]: Geol. Mijn., 12 jaargang, no. 10, pp. 282–287, 1950.

Recording of the geologic and physical properties of formations penetrated by the borehole has become an indispensible operation in any oil field. Among the newer methods of investigation, the determination of the natural radioactivity of the formations deserves attention. A gamma-ray log is obtained by moving an ionization chamber or a Geiger-Müller counter along the section of borehole being surveyed and recording the reactions on the surface. This method of logging can be applied in cased-in wells and in holes filled with oil or brine mud where electrical methods are less applicable. A comparison of gamma-ray logs with electrical ones of natural potential is presented, and their similarities and differences interpreted in terms of geologic features. In certain points these two methods are complementary.—*S. T. V.*

12474. Biedendieck, C. H. Elektrische Sondendruckmessung [An electrical drill-hole pressure meter]: Erdöl u. Kohle, Jahrg. 3, Heft 8, pp. 383–384, 1950.

A new pressure gage for either separate measurements or continuous recording of pressure in a drill hole consists of two built-in oscillators in a strong container of small over-all dimensions which can be lowered into the well. One oscillator has constant frequency; the frequency of the other is influenced by the deflection of a membrane under the action of the fluid column in the hole. Interference of the two oscillator circuits, observed on the surface on an oscilloscope determines the pressure on the diaphragm of the instrument. The error of a reading is less than 0.2 percent. The gage can be built to measure pressures up to 2,500 meters.—*S. T. V.*

12475. Tobien, H. Über eine Fernkonnektierung von Schlumberger Diagrammen im Alttertiär Nordwestdeutschland [The correlation of Schlumberger logs in the lower Tertiary of northwestern Germany]: Erdöl u. Tektonik in Nordwestdeutschland, pp. 374–382, 1949.

In many oil fields in northwestern Germany an accurate correlation of strata may be made on the basis of Schlumberger resistivity and potential logs. Such correlation was feasible between fields as far as 120 km. apart along the profile stretching in a northeast direction from Hanover to Hamburg. The potential curve was especially useful in this purpose. Accentuated peaks in the potential curve correspond to maxima of the resistivity curve, and were usually separated by sections of indefinite character, called interanomalies. The peaks usually indicate arenaceous layers, the interanomalies, argillaceous layers. Electrical logs obtained along the sea coast suggest epirogenic movements there, which are also indicated by paleontological evidence.—*S. T. V.*

12476. Schad, Albert. Stratigraphische Auswertung von elektrischen Bohrlochmessungen [Stratigraphic interpretation of electrical well logs]: Erdöl u. Tektonik in Nordwestdeutschland, pp. 364–374, 1949.

Experience has shown that the logs obtained by the Schlumberger method give a clear indication of the variations of the geologic and physical properties of the formations penetrated. In northwestern Germany the variations of facies in the horizontal direction are insignificant. Well logs, even though separated by great distances, are often very similar. This greatly facilitates the correlation of individual horizons and makes this correlation by the electrical method more accurate than can be done lithologically.

A detailed discussion of the geologic interpretation of the electrical logs and many practical examples are included.—*S. T. V.*

TECHNICAL AIDS

12477. Pivovarov, C. P. An amplifier for very low frequencies [in Russian]: Zhurnal tekhnich. fiziki, v. 18, no. 6, pp. 799–804, 1948.

An amplifier operating with sufficient stability, even at frequencies as low as 5 c.p.s., is described. The pulses applied are of rectangular shape with the horizontal portion of the wave varying less than five percent at 5 c.p.s. Anodes of the vacuum tubes have in series an electronic stabilizer. In the author's experiments the amplification was about 150,000, but this can be made substantially higher. The instrument is provided for photographic recording. The amplifier can also operate from a storage battery.—*S. T. V.*

12478. Honnell, P. M. The absolute calibration of a Brush accelerometer and its response to square waves of displacement and velocity: Am. Geophys. Union Trans., v. 31, no. 5, pt. 1, pp. 691–695, 1950.

The response of accelerometers and seismographs relative to the output of a velocity monitor is easily obtained on an electromagnetic transducer or shaking table. This equipment can give an absolute calibration by matching the peak sinusoidal acceleration of the transducer to the vertical acceleration of gravity. In practice the transducer acceleration is reduced until the chattering of an auxiliary weight resting on the platform can no longer be detected. The technique appears to be accurate within 5 percent.

The resulting calibration of a Brush BL–301 accelerometer is given, and the response of this instrument to square waves of displacement and velocity, and to simple transient wave forms, is shown.—*D. F. B.*

12479. Allsop, G., and Guénault, E. M. Exploders for simultaneous firing of shots: Great Britain Safety in Mines Research Board, Research Paper 107, 14 pp., 1950.

This pamphlet is written primarily as instruction for use in mines or quarries, but it is also of interest to geophysicists, especially when employing the Poulter seismic method of exploration. It gives an account of the electrical properties of low tension detonators which affect their firing when connected in series in a round of shots. Data are given from which it is possible to estimate the voltage and capacity needed to fire a given number of shots while taking the greatest precautions to avoid misfires which may cause accidents. The effect of leakage to the earth is also considered.—*S. T. V.*

PATENTS

MAGNETIC METHODS

12480. Fluxmeter. William R. Rathkamp, Oak Ridge, Tenn., assignor, by mesne assignments, to the United States of America as represented by the U. S. Atomic Energy Commission: U. S. patent 2,530,178, issued Nov. 14, 1950.

A device for determining magnetic field strength comprising a pulsating current conducting element forming an armature disposed in the magnetic field and being mounted to allow vibration of the element across the field so that the amplitude of the vibration is proportional to the strength of the magnetic field, and means responsive to vibration of the armature for giving an indication of the field strength comprising a member forming an armature positioned to be mechanically vibrated by the current conducting element so as to cause an e. m. f. to be generated in the member and means for measuring the magnitude of the induced e. m. f. Claims allowed, 2.

12481. Submarine-detecting device. Ellis A. Johnson, Chevy Chase, Md.: U. S. patent 2,535,068, issued Dec. 26, 1950.

In a system of the character disclosed for detecting and recording signals indicative of the presence of a submarine, a gradient device including a pair of opposedly connected nonrotating search coils adapted to generate said signals in response to variations in the intensity of the magnetic field within each of the coils, an electroresponsive device operatively connected to said coils and having an element adapted to be actuated to settings corresponding to the difference between the instant values of the flux through each of said coils, and means controlled by said element for recording said signals.

In a system of the character disclosed for attacking a submarine from an aircraft in flight, a pair of nonrotating opposedly connected search coils arranged in predetermined space relation on said aircraft and adapted to generate variable signal indications of opposite polarity in accordance with variations in the intensity of the earth's magnetic field within each of the coils, an explosive depth charge releasably supported by said aircraft, and means including a voltage integrating device operatively connected to said coils and responsive to the gradient of the magnetic field of the submarine detected by the coils for releasing the depth charge as the polarity of said signal indications is reversed during the passage of the aircraft over the submarine. Claims allowed, 20.

12482. Measuring and control method and apparatus. Thomas R. Harrison, Wyncote, and Lloyd B. Cherry, Philadelphia County, Pa., assignors, by mesne assignments, to Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., a corporation of Delaware: U. S. patent 2,535,412, issued Dec. 26, 1950.

The method of obtaining a measure of the strength of a magnetic field which consists of the steps of relatively moving a magnetic field and an exploring device to derive an electrical effect the direction of which corresponds to the direction of said magnetic field and the magnitude of which is a function of the strength of said magnetic field and also of the rate of relative movement of said magnetic field and said exploring device, applying said electrical effect to motor means to control the energization of said motor means for operation of the latter in a direction corresponding to that of said electrical effect for a period the duration of which corresponds to that of said electrical effect and at a speed which is in substantially linear accordance with the magnitude of said electrical effect, utilizing the operation of said motor means for moving an exhibiting member from a predetermined position in a direction corresponding to the direction of operation of said motor means for a period the duration of which corresponds to that of the operation of said motor means and at a rate which corresponds to the speed of operation of said motor means, utilizing the operation of said motor means for deriving a second electrical effect the magnitude of which is a function of the speed of operation of said motor means, opposing said second electrical effect and the first mentioned electrical effect in the control of the energization of said motor means to suppress the increase in the rate of motion of said exhibiting member tending to be effected by operation of said motor means as said first mentioned electrical effect increases in magnitude, thereby to expand the range of variation of said first mentioned electrical effect over which the rate of movement of said exhibiting member varies from zero to a maximum, and additionally controlling the energization of said motor means in accordance with the position of said exhibiting member as required to restore and maintain said exhibiting member in said predetermined position when the magnitude of said first mentioned electrical effect decreases below a predetermined value. Claims allowed, 26.

SEISMIC METHODS

12483. Gain control system for seismographs. George B. Loper, Dallas, Tex., assignor, by mesne assignments, to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,526,608, issued Oct. 17, 1950.

The combination with an amplifier, of a gain-controlling system therefor comprising an electric valve having an input curcuit responsive to signals from said amplifier and an output circuit, means biasing said valve beyond plate current cut-off, said valve being conductive only on signal peaks, biasing means for said amplifier comprising in a series loop a rectifier and two resistors, a ground connection at the junction of said resistors, said output circuit including one of said resistors and a capacitor connected to the cathode side of said rectifier and to one end of said last-mentioned resistor for flow of charging current through said capacitor, said rectifier having a polarity for flow therethrough of discharge current from said capacitor and through the other of said resistors continuously to develop across it a voltage of negative polarity with respect to said ground connection, and means for applying said negative voltage to said amplifier to control the gain thereof. Claims allowed, 7.

12484. Apparatus for separation of blasting-circuit leads. Josephus O. Parr, Jr., San Antonio, Tex., assignor to Olive S. Petty, San Antonio, Tex.: U. S. patent 2,527,148, issued Oct. 24, 1950.

A blasting machine for firing shots for seismic surveying including, in combination, a generator, a manually actuated plunger to rotate the generator shaft through a limited number of revolutions, conductors extending from said generator for connection to a blasting cap, a releasable connection in the circuit of each conductor located at said blasting machine, and lever means engaged and actuated by said plunger near the end of its stroke to release both said connections and thereby separate said conductors from said blasting machine. Claims allowed, 4.

12485. Drive for seismographic record strips. Robert L. Henson, Jr., and John W. Millington, Beaumont, Tex., assignors to Sun Oil Co., Philadelphia, Pa., a corporation of New Jersey: U. S. patent 2,532,911, issued Dec. 5, 1950.

In combination, means for advancing a record strip, a synchronous motor for driving said advancing means, a vibrating reed inverter for supplying alternating current for driving said synchronous motor, said inverter including an electromagnetic driving device for its reed and contact means engageable by said reed, a low voltage current supply, connections between the low voltage current supply, said driving device and said contact means through which said current supply would drive said reed at an approximately constant frequency, a tuning fork, driving means for the tuning fork, an amplifier supplying alternating current at relatively low power at the tuning fork frequency, means supplying said alternating current to said connections to maintain vibrations of said reed at the tuning fork frequency, thereby to control the frequency of the alternating current supplied by said inverter, and a synchronous motor for driving a timing device adapted to space timing markings on said record strip, said last mentioned synchronous motor being connected to said amplifier and enforcing precise uniform spacing of said timing markings. Claims allowed, 2.

12486. Seismic detector. Robert L. Henson, Jr., Beaumont, Tex., assignor to Sun Oil Co., Philadelphia, Pa., a corporation of New Jersey: U. S. patent 2,533,249, issued Dec. 12, 1950.

A seismic detector comprising means providing a rigid permanent magnet assembly having a pair of symmetrically arranged annular air gaps, a non-magnetic armature including a pair of coils and conductive elements mounting said coils located within said gaps, and spring means supporting said armature, said coils being astatically arranged so that stray magnetic fields cutting both coils induce therein bucking electromotive forces, while electromotive forces induced therein by relative movements of the coils and the magnet assembly are additive. Claims allowed, 9.

12487. Apparatus for solving seismic problems for location and dip of reflecting beds. Glenn M. McGuckin, Corpus Christi, Tex., assignor, by mesne assignments, to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,535,220, issued Dec. 26, 1950.

An instrument for contour plotting of subsurface strata comprising a pair of members having pivotal suports at points spaced in correspondence with the distance between seismic datum points and slidable in parallelism with each other, means interconnecting said members for maintaining them parallel, a scale on each of said members calibrated in terms related to seismic-reflection times, and a dip-bar extending at right angles to both of said members for all positions thereof. Claims allowed, 16.

12488. Optical recording apparatus for seismic waves. Albert J. Z. Caan, New York, N. Y., assignor to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,535,348, issued Dec. 26, 1950.

Apparatus for converting seismic recordings in terms of time to seismic recordings in terms of depth consisting of a lamp emitting light rays, a member attached thereto possessing a slit opening adjacent to said lamp, said lamp and said member being capable of reciprocation in a vertical direction to cause substantially parallel rays of energy to pass through said slit, a stationary seismic recording in terms of time aligned with said slit so as to receive said rays over its length during said reciprocation, a collimating lens for preventing the natural distortion of said rays passing through said seismic recording in terms of time, a distortion lens for distorting the rays thus corrected by said collimating lens from a time scale to a depth scale, said distortion lens having a shape determined by the time-depth curve of the area being surveyed, stationary detection means to receive the rays after they have passed through said distortion lens, said collimating lens and said distortion lens being positioned between said seismic recording in terms of time and said detection means. Claims allowed, 2.

ELECTRICAL METHODS

12489. Method of geophysical exploration. Axel Rudolf Lindblad, deceased, late of Djursholm, Sweden, by Staffan Serrander, administrator, Stockholm, Sweden, Johan David Malmqvist, Boliden, and Gotthard Viktor Arnold Gustafsson, Akeshov, Sweden, assignors to Bolidens Gruvaktiebolag, Skelleftehamn, Sweden, a joint-stock company limited of Sweden: U. S. patent 2,527,559, issued Oct. 31, 1950.

A method of detecting the presence of subterranean ore bodies and the like that comprises introducing into a transmitter coil located near the earth's surface a current varying linearly with time and causing thereby the generation of a primary electromagnetic field of saw-tooth wave form, detecting in a detector coil located at some point distant from said transmitter coil the primary field so generated, simultaneously detecting a secondary electromagnetic field in said detector coil, said secondary field resulting from the impingement of said primary field on ore bodies below the earth's surface and recording time-spaced relation the two fields so detected. Claims allowed, 2.

12490. Electrical-prospecting method. Robert R. Thompson, Houston, Tex., assignor, by mesne assignments, to Standard Oil Devel. Co., Elizabeth, N. J., a corporation of Delaware: U. S. patent 2,531,088, issued November 21, 1950.

An apparatus for conducting continuous electrical prospecting surveys over an area beneath a body of water including a self-propelled vessel, a multi-conductor cable attached to said vessel and submerged in the water for towing behind the vessel, a pair of current electrodes and a plurality of potential electrodes positioned in spaced relation upon said cable and connected to respective conductors therein, and a plurality of submerged buoys attached at spaced positions along said cable intermediate between said electrodes, said buoys being of such shape and arrangement as to lift a substantial portion of said cable off the bottom of the body of water when said vessel and cable are in motion. Claims allowed, 3.

RADIOACTIVE METHODS

12491. Wide range radiation intensity meter. Ted Fahrner, Whittier, Calif., assignor to Westinghouse Electric Corp., East Pittsburgh, Pa., a corporation of Pennsylvania: U. S. patent 2,524,901, issued Oct. 10, 1950.

A wide range radiation intensity meter comprising connections for applying a direct current potential, a Geiger-Müller counter tube and a grid controlled electron discharge tube connected in series across said connections, said counter tube being operated in the "proportional region," and means for measuring the voltage drop across said grid controlled electron discharge tube said voltage drop being a function of radiation intensity falling on said counter tube. Claims allowed, 5.

12492. Method of geophysical prospecting. John T. Callahan, La Feria, Tex., and John D. Lahmeyer, Tulsa, Okla., assignors to Industrial Nucleonic Devices, Tulsa, Okla., a corporation of Oklahoma: U. S. patent 2,526,326, issued Oct. 17, 1950.

The method of geophysical prospecting which comprises, at least partially shielding a radioactive energy detector from radioactive energy radiations from the earth, eliminating the shielding, and measuring the radio active energy reaching said detector both when shielded and unshielded to determine the relative magnitudes thereof. Claims allowed, 13.

12493. Coincidence proportional counter. John H. Manley, Urbana, Ill., assignor to the United States of America as represented by the U. S. Atomic Energy Commission: U. S. patent 2,531,144, issued Nov. 21, 1950.

A proportional counter for measuring the energy spectrum of a particle-emitting ionizing source comprising a chamber containing argon gas, a wire-like electrode suspended centrally of said chamber, a cross wire for maintaining said electrode in its central position, a source of positive high voltage connected to said electrode, a plurality of ring-shaped collecting electrodes surrounding and coaxially disposed with respect to said wire-like electrode, a coincidence amplifier circuit to which said ring-like electrodes are separately connected, said chamber having a bottom portion supporting an alpha particle emitting source below said wire-like electrode and said collecting electrodes and substantially axially thereof, conduit means for admitting gas into said chamber, and a pressure gauge connected to said conduit means for indicating the gas pressure. Claims allowed, 7.

12494. Measurement of the intensity of penetrative radiations. Jack R. Carlin, Watertown, and Eric T. Clarke, Cambridge, Mass., assignors to Tracerlab, Inc., Boston, Mass., a corporation of Massachusetts: U. S. patent 2,531,804, issued Nov. 28, 1950.

In apparatus for measuring the intensity of penetrative radiations such as are emitted by radioactive substances, the combination comprising: an ion chamber, a pair of electrodes mounted in said chamber, a source of low voltage arranged to impress a collecting voltage on said electrodes such as to produce an ionization current well below saturation value, a connection from one of said charged electrodes to carry said ionization current, means for employing said ionization current to reduce the total ionization current developed, and means for measuring the ionization current so reduced. Claims allowed 14.

12495. Electronic counting circuits. Joseph W. Kennedy, Santa Fe, N. Mex., William R. Baker, Berkeley, Calif., and Clyde E. Wiegand, Sante Fe, N. Mex., assignors to the United States of America as represented by the U. S. Atomic Energy Commission: U. S. patent 2,532,503, issued Dec. 5, 1950.

A self-contained portable counter comprising an ionization chamber, a power supply for furnishing a high potential to said ionization chamber, a pulse amplifier, a scaling circuit the input thereto being the amplified pulses, a register, and switching means for impressing the output of the scaling circuit or the amplified pulses to said register. Claims allowed, 4.

12496. Prospecting. Gerhard Herzog, Houston, Tex., assignor to The Texas Co., New York, N. Y., a corporation of Delaware: U. S. patent 2,535,066, issued Dec. 26, 1950.

In prospecting, involving the detection of the intensity of gamma radiation from the earth with a first radiation detector in the presence of cosmic rays to which it is sensitive, the improvement which comprises interposing at least one additional detector sensitive to cosmic rays in the path of the cosmic rays passing to the first detector, and observing only those rays which are detected by the first detector alone. Claims allowed, 19.

THERMAL METHODS

12497. Bolometer. Victor S. Rutherford, East Cleveland, and James F. English, Jr., Lakewood, Ohio, assignors to Bailey Meter Co., a corporation of Delaware: U. S. patent 2,524,478, issued Oct. 3, 1950.

In a bolometer of the electric resistance type, in combination, a highly evacuated sealed housing comprising a reflector portion of paraboloidal shape mirrored on the inner surface and a window portion joining the reflector portion in a plane beyond and substantially parallel to the latus rectum of the reflector; a target in said housing of extended area lying substantially in the plane of said latus rectum, spanning the focal center of the reflector and formed as a receptive grid of a relatively great length of coil-coil resistance wire having a diameter of the order of one mil and composed of a plurality of oppositely directed, laterally spaced reaches; a pair of conducting posts passing through the wall of the reflector portion; means connecting the ends of said resistance wire to said posts; and insulated means supporting said reaches in the plane of said grid. Claims allowed, 3.

WELL LOGGING

12498. Apparatus for logging wells. Jan J. Arps, Tulsa, Okla.: U. S. patent 2,524,031, issued Oct. 3, 1950.

In apparatus for logging a drill hole while drilling with a drill bit suspended in a drill hole upon a tubular drill stem and collar through which drilling fluid is circulated, the combination of: a turbine disposed within the drill stem and having its impeller means located in a drilling fluid circulating duct therein and thereby adapted to be driven by circulation of drilling fluid through said duct; a direct current generator in said drill stem; a mechanical drive connection between said turbine impeller and said direct current generator; a variable speed direct current motor; a pair of spaced electrode elements insulated from one another and positioned on and exteriorly of said drill stem to be in electrical communication with formation penetrated by the drill hole during drilling; and an electrical circuit connecting one of said electrodes to the other of said electrodes, said circuit including the output of said direct current generator connected in series with the input of said direct current motor; an alternating current generator mechanically connected to said direct current motor for generating an alternating current the frequency of which is a function of the speed of said motor; and an electromagnetic signal generator in communication with the drilling fluid duct in said drill stem, the actuating windings of which are connected to the output of said alternating current generator, for converting alternating output current from said alternating current generator into signal pulsations within said drill stem. Claims allowed, 3.

12499. Well-logging apparatus. Renic P. Vincent, Tulsa, Okla., assignor to Stanolind Oil and Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,524,150, issued Oct. 3, 1950.

In well logging apparatus including a chart and means to indicate on said chart variations in a well characteristic, an electric motor energized from an adjacent source, two oppositely rotating electrically actuated clutches driven by said motor, a single rotable shaft adapted on actuation of one of said clutches to drive the indicating means linearly, electrical means including at least one impedence responsive to a condition in said well for selectively actuating said clutches as said condition varies, and a cylindrical watertight case adapted to be lowered into a well enclosing all of said apparatus except said at least one impedence. Claims allowed, 4.

12500. Method and apparatus for well logging. William L. Russell, College Station, Tex.: U. S. patent 2,524,360, issued Oct. 3, 1950.

The method of logging wells which comprises the steps of measuring at a plurality of depths within a well the direction of the horizontal component of the earth's magnetism, said magnetism including flux due to both the induced and the remanent fields, measuring at a plurality of depths the dip of said magnetism, and recording separately the variations of said direction and of said dip as functions of depth.

Apparatus for logging wells comprising an instrument housing adapted for lowering into a well, a reference framework in said housing and movable relative thereto, means for maintaining said framework oriented in a fixed direction, means carried by said framework for producing a first electrical signal varying quantitatively with the direction of a directional magnetic property of well strata, means carried by said framework for producing a second electrical signal varying quantitatively with the strength of the magnetic field in the well strata, and means for recording the variations of each of said signals in correlation with depth in a well. Claims allowed, 17.

12501. Interface locator. Daniel Silverman, Tulsa, Okla., assignor to Stanolind Oil and Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,524,933, issued Oct. 10, 1950.

A method of indicating the position of an active interface between a conducting fluid and a nonconducting fluid in a well comprising introducing said conducting fluid into said well, introducing said nonconducting fluid into said well, said conducting and said non-conducting fluids being immiscible and of different densities, whereby an interface is formed in said well, locating a detector in the region of said interface, said detector being adapted to distinguish between said conducting and said nonconducting fluids, indicating at the surface in which fluid said detector is submerged, and cyclically submerging said detector alternately in said conducting and said nonconducting fluids, the frequency of said submersions being between about ⅒ and about 20 cycles per minute, whereby a positive qualitative signal will be repeatedly and intermittently produced at the surface when said detector is in the region of said interface and the ratio of signal-on to signal-off time indicates the mean level of said interface relative to said detector. Claims allowed, 12.

12502. Method for logging wells. Preston E. Chaney, Beaumont, Tex., assignor to Sun Oil Co., Philadelphia, Pa., a corporation of New Jersey: U. S. patent 2,526,857, issued Oct. 24, 1950.

In the logging of subterranean formations penetrated in well drilling operations by analyzing effluent drilling mud fluid for salt content, the method of continuously determining changes in the concentration in said drilling mud fluid of chloride ions, which comprises continuously circulating drilling mud fluid containing added phosphates, and having a pH of from 7 to 9.5, into and out of said well during the drilling operation, contacting the effluent drilling mud fluid with an electrode of reference potential and a silver electrode, and measuring the potential difference between said electrodes. Claims allowed, 3.

12503. Method of logging wells. John T. Hayward, Tulsa, Okla.: U. S. patent 2,528,882, issued Nov. 7, 1950.

The method of logging wells being drilled by the rotary method in which a drilling fluid circulated through the well is analyzed at the top of the well for the contents of the strata portions dispersed therein by the drill, comprising, modulating a drilling operation at a predetermined frequency adapted to correspondingly vary the rate of dispersal by said drill of said contents of said strata per unit volume of said drilling fluid, and analyzing said drilling fluid for said contents appearing therein in a concentration pattern corresponding to said frequency. Claims allowed, 19.

12504. Radio-activity logging of wells. John T. Hayward, Tulsa, Okla.: U. S. patent 2,528,955, issued Nov. 7, 1950.

In drilling of a well by the rotary method employing a circulating stream of drilling fluid, the method of logging the well, comprising, separating from the stream of returning drilling fluid the formation cuttings in the order in which they are deposited in said stream by the drill, and measuring the radioactivity of the so separated cuttings. Claims allowed, 10.

12505. Acoustic well-logging apparatus. Clare H. Kean, Houston, Tex., assignor by mesne assignments, to Standard Oil Devel. Co., Elizabeth, N. J., a corporation of Delaware: U. S. patent 2,530,971, issued Nov. 21, 1950.

An improved apparatus for acoustic impedance logging of formations along the liquid-filled portion of a borehole in the earth comprising, in combination, a transducer of acoustic wave energy of substantially a selected frequency having such a value that the wave length of said wave energy in the borehole liquid is longer than the diameter of the borehole, said transducer comprising an elongated element constituting a wave generating surface having a greater length than said wave length and electromagnetic means operatively associated with said element for causing the latter to vibrate in extensional mode at said frequency, a source of electric energy electrically connected to said electromagnetic means for exciting the latter at said frequency, means for moving said transducer along the formations in the borehole, and means for recording variations in electric energy supplied to said electromagnetic means as the transducer is moved along the formations. Claims allowed, 6.

12506. Well-logging recorder. Herschell R. Scivally, Shreveport, La.: U. S. patent 2,535,096, issued Dec. 26, 1950.

A well-logging machine for use in connection with rotary drilling equipment having a rotatable drill stem, which comprises, means holding and advancing a movable record receiving element, said means connecting with said rotary drilling equipment in a manner to advance said record receiving element at a rate of speed determined by the speed of the downward movement of said drill stem, a stylus movably positioned above and adapted to mark said record receiving element, a power driven screw shaft and gearing connecting the latter with said stylus, a movable clutch and gearing connecting said screw shaft with a driving means to rotate the latter at selected rates of speed, linkage and gearing connecting said clutch with said means for holding and advancing said record receiving element, said linkage and gearing operative with said advancing means to move said movable clutch and reverse the direction of rotation of said screw shaft and the direction of movement of said stylus, and providing thereby a marked record of the time consumed for a predetermined increment of downward movement of said drill stem. Claims allowed, 5.

12507. Electrical-logging system. Robert A. Broding, Dallas, Tex., assignor, by mesne assignments, to Socony-Vacuum Oil Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,535,666, issued Dec. 26, 1950.

A system for measuring changes in the electrical character of formations penetrated by a borehole which comprises an exploring unit movable along the borehole and including as a component part thereof an alternating current bridge network having an elongated inductance forming one arm of said network and disposed lengthwise of said borehole for producing an electromagnetic field in the strata adjacent thereto, said bridge having circuit connections for application thereto of alternating current input signals and output connections, means for establishing balanced conditions in said bridge network with said exploring unit in a predetermined position, means for moving said exploring unit in said borehole past said formations to unbalance said bridge in accordance with variations in the electrical properties of said formations for production of signals, and measuring means including a detecting circuit having branches respectively connected to said circuit connections and to said output connections in which the signals applied thereto are opposed, said measuring means including an element movable in accordance with the algebraic difference between said signals to indicate an electrical characteristic of said formations. Claims allowed, 18.

TECHNICAL AIDS

12508. Elevation-recording apparatus. Daniel Silverman, Tulsa, Okla., assignor to Stanolind Oil and Gas Co., Tulsa, Okla., a corporation of Delaware: U. S. patent 2,524,934, issued Oct. 10, 1950.

In elevation-surveying apparatus of the type including a gravity-responsive pendulum for supplying a reference direction for the measurement of grade angles, said pendulum being responsive also to accelerations of the transporting vehicle along the traversed path, means for correcting the elevation indications of said apparatus while said vehicle is in motion for the error introduced by said accelerations comprising: means for producing an electrical output proportional to the vehicle speed, means actuated by said electrical output for producing a motion proportional to the square of the vehicle speed, and means utilizing said motion for altering the elevation indications of said apparatus whereby substantially correct values thereof are given while said vehicle is in motion. Claims allowed, 8.

12509. Geophysical safety catch. Lloyd R. Deputy and Lena F. Deputy, Jennings, La.: U. S. patent 2,529,763, issued Nov. 14, 1950.

In combination with an explosive charge enclosing sleeve, a spring support mounted on the sleeve and adapted to support it in a vertical conduit, said spring support including a resilient strand and a sleeve encircling metal strap securing the strand to the sleeve, said strap having fastening means adjustably connecting the ends thereof and securing the strap around the sleeve, inwardly extending prongs struck from the strap and embedded in the sleeve, said strap having oppositely disposed outwardly offset portions, said strand having an arcuate intermediate portion engaging partially around the sleeve below the strap, said arcuate intermediate portion terminating in upwardly extending leg portions disposed between the sleeve and the outwardly offset portions of the strap, said strand having corresponding upwardly diverging end portions projecting from the upper ends of said upwardly extending leg portions each having an outturned conduit wall engaging terminal, said upwardly diverging end portions being biased outwardly by the resiliency of the strand for urging the outturned terminals into frictional engagement with the wall of the conduit to support the charge enclosing sleeve in the conduit. Claims allowed, 1.

12510. Detonation voltage measuring means. Deslonde R. de Boisblanc, Bartlesville, Okla., assignor to Phillips Petroleum Co., a corporation of Delaware: U. S. patent 2,534,004, issued Dec. 12, 1950.

The method of indicating the average amplitude of a sequence of voltage pulses comprising the steps of transmitting the pulses in a plurality of channels, integrating the pulses in a first channel which resulting integral is a function of the product of the average amplitude and average frequency of occurrence of said pulses, creating a voltage in a second channel proportional to the average frequency of occurrence of, but independent of the amplitude of, said pulses, applying said integral to move the indicator of an indicating device, and applying said voltage from said second channel to control said indicating device to vary the sensitivity thereof inversely as a function of the frequency of said pulses, whereby the average amplitude of said pulses is indicated. Claims allowed, 15.

12511. Detonation meter. Deslonde R. de Boisblanc, Bartlesville, Okla., assignor to Phillips Petroleum Co., a corporation of Delaware: U. S. patent 2,534,005, issued Dec. 12, 1950.

In a detonation meter the combination comprising means producing electrical voltages in response to pressure changes, a low pass filter tuned to pass selected frequency components of detonation, an amplifier, a threshold device comprising a vacuum tube having a grid, an adjustable negative grid bias resistor for said tube, said resistor being adjusted so that said threshold device amplifies only detonation generated voltages above a predetermined value, a rectifier, and integrating circuit and a vacuum tube voltmeter all connected in series in the exact order set forth in this claim.—Claims allowed, 5.

12512. Galvanometer. Carl A. Heiland, Denver, Colo., assignor to Heiland Research Corp., Denver, Colo., a corporation of Colorado: U. S. patent 2,535,065, issued Dec. 26, 1950.

An electrical galvanometer comprising, a field structure having pole pieces and a source of magnetic lines of force, a ribbon fixed at its ends with respect to said field structure, a coil mounted on said ribbon for oscillatory movement between said pole pieces, a concave cylindrical mirror mounted with its axis extending vertically and parallel to the axis of said ribbon for movement with said coil, and means for adjusting said galvanometer bodily about the center of said mirror. Claims allowed, 14.

12513. Projection-vibration indicator. Bernard William Smith, Winston-Salem, N. C., assignor to Western Electric Co., Inc., New York, N. Y., a corporation of New York: U. S. patent 2,535,326, issued Dec. 26, 1950.

In a vibration-testing apparatus, a light source, a viewing screen, a movable member having one end adapted to contact and vibrate with a unit to be tested, the other end of said member having an aperture adapted to be interposed and vibrate between the light source and the viewing screen, and means for projecting an image of said aperture upon said screen whereby a movement of the unit being tested will be transmitted through the vibrating aperture into a movement of an image of the aperture upon the viewing screen. Claims allowed, 12.

INDEX

Abstract
Abelès, Florin 12461
Agarwala, K. S 12371
Akimoto, Syun'iti 12363
Aler, Bo 12415
Alfvén, Hannes 12355
Allsop, G 12479
Andrée, Karl 12434
Arps, J. J 12498

Baker, W. R 12495
Beer, Michael 12349
Belluigi, Arnoldo 12462, 12463, 12464
Benfield, A. E 12424
Bernard, Pierre 12407
Biedenieck, C. H 12474
Blaha, Friedrich 12357
Bogdanov, A. A 12351
Bonchkovskii, V. F 12438
Brasil Conselho nacional de petroleo 12441
Broding, R. A 12507
Broggi, J. A 12372
Brooks, J. A., Jr 12454

Caan, A. J. Z 12488
Callahan, J. T 12492
Caloi, Pietro 12384, 12408
Campbell, F. F 12455
Carlin, J. R 12494
Cervera del Castillo, E 12472
Chaney, Preston 12502
Cherry, L. B 12482
Clarke, E. T 12494
Coats, R. R 12428
Cook, A. H 12352
Cook, K. L 12449
Coppens, René 12421
Cooper, W. G. G 12468
Cummings, J. B 12470

de Boisblanc, D. R 12510, 12511
Deputy, L. F 12509
Deputy, L. R 12509
Dessau, G 12442
d'Henry, G 12409
Dobrin, M. B 12388

English, J. F., Jr 12497
Evseev, S. V 12345

Fabiano, Ramiro 12439
Fahrner, Ted 12491
Ferraz de Carvalho, Anselmo 12368
Festa, C 12418
Förtsch, Otto 12386
Fries, Carl, Jr 12431

Abstract
Galanopulos, A. G 12393
Gassmann, Fritz 12375
Giorgi, Maurizio 12366, 12410
Goguel, Jean 12435
Goranson, R. W 12387
Gorshkov, G. P 12394
Graf, T 12416
Greig, J. W 12387
Guénault, E. M 12479
Gurevich, B. L 12351
Gustafsson, G. V. A 12489
Gutiérrez, Celedonio 12431

Haarstick, Fritz 12452
Hallenbach, Franz 12444
Hammer, Sigmund 12447
Harrison, T. R 12482
Hayward, J. T 12503, 12504
Hée, Arlette 12422, 12423
Heiland, C. A 12512
Henson, R. L., Jr 12485, 12486
Hertwig, August 12458
Herzog, Gerhard 12496
Hirao, Kunio 12365
Honnell, P. M 12478
Howe, H. H 12362
Huber, A 12459

Ikegami, Ryohei 12379, 12403
Ingham, F. T 12450
Ippolito, Felice 12420

Jaggar, T. A 12426
Jarovoy, Michel 12423
Johansson, S. A. E 12417
Johnson, E. A 12481
Júdice, António 12341, 12342

Kanai, Kiyoshi 12383
Kean, C. H 12505
Kennedy, J. W 12495
Kirnos, D. P 12373
Kleiber, Joseph 12423
Klompé, Th. H. F 12432
Kondorskii, E. I 12358
Korn, H 12396
Koshikawa, Yoshiaki 12367
Krey, Theodore 12457
Krinitzsky, E. L 12390

Lahmeyer, J. D 12492
Langhammer, A 12453
Leiviskä, Iivari 12436
Lejay, Pierre 12353
Lindblad, A. R 12489
Loper, G. B 12483
Lundberg, Hans 12471

Abstract

Macdonald, G. A. 12429
Macelwane, J. B. 12370
McGuckin, G. M. 12487
Magnitskii, V. A. 12344
Manfredini, Antonio 12466
Malmqvist, J. D. 12489
Manley, J. H. 12493
Marcelli, L. 12384
Martin, Hans 12396
Masarskii, S. I. 12395
Medi, Enrico 12366
Melchior, P. J. 12346
Millington, J. W. 12485
Milosavlević, R. A. 12392
Minakami, Takeshi 12404, 12433
Morelli, Carlo 12360, 12366, 12411
Mukhina, G. V. 12460
Murphy, L. M. 12389
Myers, J. O. 12465

Nagata, Takeshi 12363, 12365
Nasu, Nobuji 12378, 12397
Noetzlin, J. 12437
Norges Geografiske Oppmålings virksomket 12350
Norinder, Harald 12413

Olczak, Tadeusz 12445
Omer, G. C. J. 12427
Omote, Syun'itiro 12400, 12401
Orr, J. B. 12429
Oulianoff, Nicolas 12398

Pannocchia, G. 12384
Parr, J. O., Jr. 12484
Paver, G. L. 12467
Peronaci, Francesco 12385
Petroeschevsky, W. A. 12432
Pivovarov, C. P. 12477

Rathkamp, W. R. 12480
Rayner, J. M. 12451
Redding, V. L. 12454
Rikitake, Tsuneji 12364, 12412, 12425
Roberts, E. B. 12369
Romslo, T. M. 12470
Rooney, W. J. 12387
Rosini, E. 12410
Röthlisberger, Hans 12381
Rummerfield, B. F. 12456
Russell, W. L. 12500
Rutherford, V. S. 12497

Abstract

Sakuma, Shuzo 12404, 12405
Salka, Oskars 12413
Santangelo, M. 12418
Sato, Yasuo 12399, 12402
Savarenskii, E. F. 12373
Schad, Albert 12476
Schulze, G. A. 12386
Scivally, H. R. 12506
Sellien, K. 12448
Sergeev, M. N. 12340
Shereskevskai͡a, S. I͡A. 12351
Silverman, Daniel 12501, 12508
Slotnick, M. M. 12454
Smith, B. M. 12513
Smith, N. J. 12446
Sulkowski, E. I. 12376

Taborda, B. A. 12440
Takeuchi, Hitoshi 12343
Tatel, H. E. 12419
Tercedor, Mariano 12391
Thomeer, J. H. M. A. 12473
Thompson, R. R. 12490
Tikhonov, A. N. 12414
Tobien, H. 12475
Truesdell, C. 12356
Tsuboi, Chuji 12348
Tsubokawa, Ietsume 12359
Tuve, M. A. 12387

Ulrich, F. P. 12369

Valderrama Suárez, Mariano 12406
Valle, P. E. 12374
Vening Meinesz, F. A. 12354
Vincent, R. P. 12499
Voit, H. 12347
Volk, J. A. 12377, 12380

Walters, R. C. S. 12469
Wasserfall, K. F. 12361
Weber, Max 12375
West, S. S. 12382
West, W. D. 12443
Whetton, J. T. 12465
Wiegand, C. E. 12495
Williams, Howel 12430

Yoshikawa, Haruo 12365

○

To avoid fine, this book should be returned on
or before the date last stamped below